Scheme of Teaching, Examination and Syllabus

B.E. COMPUTER SCIENCE AND ENGINEERING

Batch: 2022-23

ThirdYear

(V and VI SEMESTER)

(Effective from the academic year 2024-2025)

SreeSiddaganga Education Society®

Siddaganga Institute of Technology

(An Autonomous institute affiliated to Visvesvaraya Technological University, Belagavi)

(Approved by AICTE, New Delhi, Accredited by NAAC and ISO 9001-2015 certified)

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SCHEME OF TEACHING AND EXAMINATION (160 Credits Scheme)

(Effective from the academic year 2024-2025)

V Semester

B.E. in Computer Science & Engineering **Batch: 2022-2023**

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	HSMS		Software Engineering and Project Management	Dept.	3	0	0	3.5(48 hrs)	3	50	50	100	3
2.	IPCC	S5CCSI01	Database Management System(I)	Dept.	3	0	2	3.5(50 hrs)	3	50	50	100	4
3.	IPCC	S5CCSI02	Artificial Intelligence and Machine Learning(I)	Dept.	3	0	2	3.5(50 hrs)	3	50	50	100	4
4.	PCCL	S5CSL01	Data Science with Python Lab	Dept.	0	0	2		3	50	50	100	1
5.	PEC		Professional Elective Course-I	Dept.	3	0	0	3.5(48 hrs)	3	50	50	100	3
6.	PROJ		Mini Project / Extension Survey Project	Dept.	0	0	4		3	100	-	100	2
7.	AEC		Research Methodology and IPR **(Board: IEM)**	ME, IM, CH	2	2	0	2.0(34hrs)	3	50	50	100	3
8.	HSMS	HS06	Environmental Studies **(Board: CV)**	CV	2	0	0	2.0(32hrs)	3	50	50	100	2
9.	NCMC		Soft Skills (Additional Course offered by SIT)	T&P	0	2	0		-	100	-	100	0
10.	NCMC	NS	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		PE	Physical Education (PE) (Sports and Athletics)	PED									
		YO	Yoga	PED									
			Total							**550**	**350**	**900**	**22**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours commUNITy service to be documented and produced for the examination									

Note: HSMS: Humanity and Social Science and management Course **IPCC**: Integrated Professional Core Course, **PCCL**: Professional Core Course laboratory,

PEC: Professional Elective Course**; PROJ**: Project/Mini Project; **AEC**: Ability Enhancement Course; **NCMC**: Non-Credit Mandatory Course,

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course (PEC) (Offered by the Department)

S5CSPE01	Compiler Design	S5CSPE03	Computer Graphics & Image Processing
S5CSPE02	Software Testing	S5CCSPE01	Information Retrieval

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only

CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

SCHEME OF TEACHING AND EXAMINATION (160 Credits Scheme)

(Effective from the academic year 2024-2025)

VI Semester

B.E. in Computer Science & Engineering **Batch: 2022-2023**

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	IPCC	S6CSI01	Computer Networks(I)		3	0	2	3.5(50 hrs)	3	50	50	100	4
2.	PCC	S6CS01	Internet of Things		3	0	2	3.5(50 hrs)	3	50	50	100	4
3.	PEC		Professional Elective Course-II		3	0	0	3.5(48 hrs)	3	50	50	100	3
4.	OEC		Open Elective Course-I		3	0	0	3.5(48 hrs)	3	50	50	100	3
5.	PROJ		Major Project Phase I		0	0	4		3	100	-	100	2
6.	PCCL		Mobile Application Development Lab		0	0	2		3	50	50	100	1
7.	AEC		Aptitude Related Analytical Skill		0	0	2		1½	50	50	100	1
8.	NCMC	NS	National Service Scheme (NSS)	NSS CO	0	0	2			100	-	100	0
		PE	Physical Education (PE) (Sports and Athletics)	PED									
		YO	Yoga	PED									
			Total							**500**	**300**	**800**	**18**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours commUNITy service to be documented and produced for the examination									

Note: **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Course; **PEC**: Professional Elective Course**;**
OEC: Open Elective Course; **PROJ:** Project Phase –I; **PCCL**: Professional Core Course laboratory;
AEC: Ability Enhancement Course, **SEC**: Skill Enhancement Course; **NCMC**: Non Credit Mandatory Course;
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course (PEC) (Offered by the Department)

S6CSPE01	High Performance computing	S6CCSPE01	Cloud Computing
S6CSPE02	Block chain Technology	S6CSPE03	Cryptography & Network security

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education

(PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Scheme of Teaching, Examination and Syllabus

B.E. COMPUTER SCIENCE & ENGINEERING

Batch: 2022-23

V SEMESTER

(Effective from the academic year 2024-2025)

B.E COMPUTER SCIENCE & ENIGEERING

Outcome Based Education(OBE) and Choice Based Credit System(CBCS)

SEMESTER–V

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Course Code		CIE Marks	50
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

1. To define software engineering and explain importance of project management.
2. To explain process of gathering software requirements and modeling complex software systems.
3. To explain process of designing complex software products, implementing the software design and testing the developed product.
4. To explain the importance of project management
5. To learn about software engineering and project management in an industrial context.

UNIT-1 **(8L+0THrs)**

1.1 **Software Engineering:** Engineering, Creativity and Craft (R1-2); Professional SoftwareDevelopment (T1-1.1); Software Engineering (R1-1, R2-1.1); Birth of Software Engineering(R1-1); Foundations of Software Engineering Discipline (R1-3); Experts and Learning (R1-3);ExpertsatManagingComplexity(R1-3);SoftwareEngineeringBodyofKnowledge(R2-14.4);

1.2 **Software Processes**: Software Process Models (T1-2.1, R2-2.2); Process Activities (T1-2.2);Copingwith Change(T1-2.3);

1.3 **Agile Software Development**: Agile Methods (T1-3.1); Agile Development Techniques (T1-3.2);Agile Project Management (T1-3.3);

1.4 **Project Management**: The Project Management Body of Knowledge (W2); ProjectManagementKnowledgeAreas(W3)

UNIT-2 **(8L+0THrs)**

2.1 **Requirements Engineering**: Requirements Engineering (T1-4); Functional and Non-Functional Requirements (T1-4.1); Requirements Engineering Process (T1-4.2); RequirementsElicitation (T1-4.3); Requirements Specification (T1-4.4); Requirements Validation (T1-4.5,R2-4);Requirements Change (T1-4.6);

2.2 **System Modelling**:Context Models (T1-5.1); Interaction Models (T1-5.2); Structural Models(T1-5.3);Behavioural Models (T1-5.4);Model Driven Engineering (T1-5.5);

2.3 **Architectural Design**: Architectural Design Decisions (T1-6.1); Architectural Views (T1-6.2);ArchitecturalPatterns (T1-6.3);Application Architectures (T1-6.4,R2-5.48.1)

UNIT-3 **(8L+0THrs)**

3.1 **Design and Implementation**:Incrementalism in Software Development (R1-6); ObjectOriented Design using UML (T1-7.1); Design Patterns (T1-7.2); Achieving Quality Attributes(R2-5.5);Writing Programs (R2-7);

3.2 **Software Testing**: Development testing (T1-8.1, R2-8); Test driven development (T1-8.2);Releasetesting (T1-8.3); User testing (T1-8.4);

3.3 **Software Evolution**: Software Evolution (T1-9.1); Legacy Systems (T1-9.2); Software Maintenance (T1-9.3)

UNIT-4	**(8L+0THrs)**

4.1 **Project Management**:Overview (W3); Risk Management (T1-22.1); Boehm's Top Ten RiskItems (R2-3.4); Members of the Development Team (R2-1.7); Teamwork (T1-22.3); ManagingPeople(T1-22.2);

4.2 **Project Planning**: Working Iteratively (R1-4); Plan Driven Development (T1-23.2); TheProject Plan (R2-3.5); Agile Planning (T1-23.4); Estimation Techniques (T1-23.5, R2-3.3);ProjectScheduling (T1-23.3); COCOMO CostModeling (T1-23.6);

4.3 **Complexity Management**: Software Complexity (R1-III); Methods of Managing Complexity(R1-III,R2-6.2);

4.4 **Quality Management**: What is Good Software? (R2-1.3); Feedback in Software Development(R1-5); Software Quality (T1-24.1); McCall's Quality Model (R2-1.3); Software Standards (T1-24.2); Reviews and Inspections (T1-24.3); Quality Management in Agile Development (T1-24.4);SoftwareMeasurements (T1-24.5);

4.5 **Configuration Management**: Version Management (T1-25.1); System Building (T1-25.2);ChangeManagement (T1-25.3); ReleaseManagement (T1-25.4)

UNIT-5	**(7L+0THrs)**

MLOps: Need and benefits of MLOps vs DevOps, MLOps Phases, MLOps architecture and components

Industrial Case Study: Defining, architecting, designing, developing, testing, releasing, and maintaining a complex software product and managing the associated project.

Course outcomes:

On successful completion of this course, students will be able to:

1. Analyze fundamental processes of software engineering and project management.
2. Analyze the functional and non-functional requirements.
3. Practice the software estimation, architecture and design principles.
4. Implement software design and test the quality of software products.
5. Identify and practice specific techniques of project management.

Sl. No.	TitleoftheBook	NameoftheAuthor/s	NameofthePublisher	Edition andYear
Textbooks				
T1	**SoftwareEngineering** ISBN:978-93-325-8269-9	IanSommerville	Pearson EducationLimited	10th Edition2017
Reference Books				
R1	**Modern Software Engineering:Doing What Works to BuildBetterSoftware Faster** ISBN:978-0-13-731491-1	DavidFarley	Addison-Wesley	2022
R2	**Software Engineering: TheoryandPractice** ISBN:978-81-317-6062-8	Shari Lawrence PfleegerJoanneM Atlee	Pearson	4th Edition 2013
WebResources				

W1	**Supportingmaterial forT1** https://software-engineering-book.com/
W2	**PMBOK 7thEdition Summary** https://www.projecttimes.com/articles/the-pmbok-guide-seventh-edition-summary/
W3	**PMBOKKnowledgeAreas** https://www.projectengineer.net/the-10-pmbok-knowledge-areas/

Course Articulation matrix (CO-PO Mapping)

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2													2	
CO2		2												2	
CO3			3											2	
CO4											3			2	
CO5			3								3			2	
Overall CO	2	2	3								3			2	

Degree of compliance 1: Low 2: Medium 3: High

Program Articulation Matrix: (PO-PSO Mapping)

Course	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
SE & PM	2	2	3								3			2	

Degree of compliance 1: Low 2: Medium 3: High

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

DATABASE MANAGEMENT SYSTEM(I)

Course Code	S5CCSI01	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	4	Exam Hours	3
Lecture Hours	40 hrs	Practical Hour	26 hrs

Course objectives: The course will enable students to

1. To define a Database, characteristics and functions of Database Management System and distinguish between a Traditional File System and a Database System.
2. To model the real world database systems using Entity Relationship Diagrams (ERD) from the requirements specification and transform it to a relational model.
3. To designSQL and NoSQL queries to perform CRUD (Create, Retrieve, Update and delete) operations on database.
4. To apply normalization techniques to normalize a Relational database
5. To illustrate how a DBMS handles transactions by enforcing recovery from failure and concurrency control

UNIT-1 **(6hrs)**

DATABASES AND DATABASE USERS: Introduction; An example; characteristics of the database approach; actors on the scene; workers behind the scene; advantages of using the DBMSapproach;AbriefhistoryofdatabaseApplications;whenNottouseaDBMS. Chapter 1 : 1.1 – 1.8

DATABASE SYSTEM – CONCEPTS AND ARCHITECTURE: Data models, schemas, and instances; three schema architecture and data independence; database languages and interfaces; the database system environment; centralized and client/server/architectures for DBMSs. Classification of database management system. Chapter 2 : 2.1 to 2.6

UNIT-2 **(8hrs)**

ENTITY-RELATIONSHIP MODEL: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and DesignIssues. Chapter 7 : 7.1 to 7.7

RELATIONAL MODEL

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and Dealing with Constraint Violations; Relational Database Design using ER- to-Relational Mapping.: Chapter 3 : 3.1 to 3.3, Chapter 9 : 9.1

UNIT-3 **(9hrs)**

SQL-THE RELATIONAL DATABASE STANDARD: SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL; Basic Queries in SQL; More Complex SQL Queries; Insert, Delete and Update Statements in SQL; Additional Features of SQL; Specifying General Constraints as Assertion; Views (Virtual Tables) in SQL. **Chapter 4 : 4.1 to 4.4,Chapter 5 : 5.1 to 5.3**

MangoDB tutorial, MangoDB operators, DB commands, Database, collection, CRUD
URL: www.javatpoint.com/nosql-databases

UNIT-4 **(8 hrs)**

DATABASE DESIGN: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions. Chapter 15 : 15.1 to 15.5 , Chapter 16 : 16.2

UNIT-5 **(9hrs)**

TRANSACTION PROCESSING CONCEPT: Introduction to transaction processing; transaction and system concepts; desirable properties of transactions, characterizing schedules based on recoverability and serializability; transaction support inSQL Chapter 21 : 21.1 to 21.6

CONCURRENCY CONTROL & DATABASE RECOVERY TECHNIQUES: Two phase locking techniques, Concurrency control based on Timestamp ordering; Recovery concepts; recovery based on deferred update and Immediate Update, Shadow Paging, ARIES Recovery Algorithm Chapter 22 : 22.1 – 22.2, Chapter 23: 23.1 to 23.5

Course outcomes:

On successful completion of this course, students will be able to:

CO1: Describe the fundamentals of database technologies.

CO2: Design an ER diagram andtransform it to a relational model for a given database specification.

CO3: Design SQL and NoSQL queries to perform CRUD (Create, Retrieve, Update and delete) operations on database.

CO4: Apply Informal Design guidelines and normalization techniques to improve database design

CO5: Analyse Concurrency control and Database recovery techniques in transaction processing.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Fundamentals of Database Systems	ElmasriandNavathe	Pearson Education	6th Edition,2011
Reference Books				
1	Data base System Concepts.	Silberschatz, Korth and Sudharshan.	McGraw-Hill	6th Edition, 2010
2	Database Management Systems.	Raghu Ramakrishnan and Johannes Gehrke	McGraw-Hill.	3th Edition, 2010

URL: www.javatpoint.com/nosql-databases

Lab Component	
Sl. no.	**Experiments**
1	Suppose a movie_studio has several film crews. The crews might be designated by a given studio as crew1, crew 2, and so on. However, other studios might use the same designations for crews, so the attribute crew_number is not a key for crews. Movie_studio holds the information like name, branch and several locations. Each crew holds information like sector andstrength. **i)** Establish the database by normalizing up to 3NF and considering all schema level constraints **ii)** Write SQL insertion query to insert few tuples to all therelations **iii)** List all movie studios which are not used a singlecrews. **iv)** Retrieve the movie studio which uses highest strengthcrew. **v)** Write a before insert trigger to check maximum number of crews to any studio is limited to 5. **vi)** Write a procedure retrieve all crews used by specificstudio.
2	The production company is organized into different studios. We store each studio's name branch and location; every studio must own at least one movie. We store each movie's title, sensor number and year of production. Star may act in any number of movies and we store each actors name and address.

	i) Establish the database by normalizing up to 3NF and considering all schema level constraints **ii)** Write SQL insertion query to insert few tuples to all therelations **iii)** List all the studios of the movie“xyz”; **iv)** List all the actors , acted in a movie ‘xyz’ **v)** Write a procedure to list all movies produced during the specificyear. **vi)** Write a deletion trigger, does not allow to deleting current yearmovies.
3	The production company is organized into different studios. We store each studio’s name branch and location; a studio own any number of Cartoon-serials. We store each Cartoon-Serial’s title, sensor number and year of production. Star may do voices in any number of Cartoon-Serials and we store each actors name andaddress. **i)** Establish the database by normalizing up to 3NF and considering all schema level constraints **ii)** Write SQL insertion query to insert few tuples to all therelations **iii)** Find total no of actors, do voiced in a Cartoon-Serials‘xyz’ **iv)** Retrieve name of studio, location and Cartoon-Serials title in which star “abc” is voiced. **v)** vii. Write a procedure to list all Cartoon-Serials produced during the specific year. **vi)** v. Write a deletion trigger, does not allow to deleting current year Cartoon-Serials.
4	Car marketing company wants keep track of marketed cars and their owner. Each car must be associated with a single owner and owner may have any number of cars. We store car’s registration number, model &color and owner’s name, address & SSN. We also store date of purchase of eachcar. **i)** Establish the database by normalizing up to 3NF and considering all schema level constraints **ii)** Write SQL insertion query to insert few tuples to all therelations **iii)** Find a person who owns highest number ofcars **iv)** Retrieve persons and cars information purchased on the day 11-11-11 **v)** Write a insertion trigger to check date of purchase must be less than current date (must use systemdate) **vi)** Write a procedure to list all cars and owner information purchased during the specific year.
5	Puppy pet shop wants to keep track of dogs and their owners. The person can buy maximum three pet dogs. We store person’s name, SSN and address and dog’s name, date of purchase and sex. The owner of the pet dogs will be identified by SSN since the dog’s names are notdistinct. **i)** Establish the database by normalizing up to 3NF and considering all schema level constraints **ii)** Write SQL insertion query to insert few tuples to all therelations **iii)** List all pets owned by a person‘Abhiman’. **iv)** List all persons who are not owned a singlepet **v)** Write a trigger to check the constraint that the person can buy maximum three pet dogs **vi)** Write a procedure to list all dogs and owner details purchased on the specificdate.

6	**No SQL:** Lab 1. Installation and set up of MongoDB client and server Lab 2. Create a database collection using MongoDB environment. For example a documentcollection meant for analyzing Restaurant records can have fields like restaurant_id, restaurant_name, customer_name, locality, date, cuisine, grade, comments. etc. Lab 3. Create database using INSERT, UPDATE, UPSERTS, DELETE and INDEX. Lab 4. Practice writing simple MongoDB queries such as displaying all the records, display selected records with conditions Lab 5. Experiment with MongoDB comparison and logical query operators - $gt, $gte, $lt, $lte, $in, #nin, $ne, $and, $or, $not Lab 6. Practice exercise on element, array based and evaluation query operators - $exists, $type, $mod, $regex

Course outcomes:

After the completion of the course, the student will be able to:

1. Apply the knowledge of database management system development process and conduct the experiments using SQL and NoSQL queries to find the solution for givendatabase problem.
2. Design ER Model & its mapping to relational for a given problem
3. Develop code for stored programs& triggers.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered bythe examiners.
- Students can pick one experiment from the questions lot prepared by the examiners.
- Change of experiment is allowed only once and 20% Marks is to be deducted.

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	2	2										2		
CO2	2		2										2		
CO3	2		3										3		
CO4	2	2											2		
CO5	2		2										2		
Overall CO	2	2	3										3		

Program articulation matrix:

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1-5	2	2	3										3		

Degree of compliance **1**: Low **2**: Medium **3**: High

B.E COMPUTER SCIENCE AND ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (I)

Course Code	S5CCSI02	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	4.0	Exam Hours	03 Hours
Lecture Hours	40 hrs	Practical Hour	26 hrs

Course objectives: The course will enable students to

1. Explain the basics of Artificial Intelligence and Machine Learning algorithms
2. Identify the problems where Artificial Intelligence and Machine Learning techniques are applicable.
3. Discuss knowledge representation issues and different kind of learning algorithms.
4. Compare learning strategy adopted by various kinds of machine learning algorithms.

UNIT-1 **(08L+4Phrs)**

What is artificial intelligence? What is AI? Acting humanly and thinking humanly, thinking rationally and acting rationally, Intelligent Agents: Agents and Environments, Good Behavior: The concept of Rationality: Rationality, Omniscience, Learning and autonomy, The nature of Environments: specifying the task environment, properties of task environments, The structure of Agents: Agent Programs, simple reflex agents, Model-based reflex agents, Goal-based agents, Utility-based agents, Learning agents, How the components of agents programme work, Solving problems by Searching: problem-solving agents, well-defined problems and solutions, Example problems.
Searching for Solutions: infrastructure for search algorithms, measuring problem-solving performance.
Textbook-1: Chapter 1: 1.1 to 1.5, Chapter 2: 2.1 to 2.5

UNIT-2 **(08L+8P hrs)**

Search strategies: Uninformed Search strategies: BFS, uninform-cost search, DFS, depth-limited search, iterative deepening depth-first search, bidirectional search, comparing uniformed search strategies, Informed search strategies: Greedy best-first search, A* search, Memory-bounded heuristic search, learning to search better, Constraint satisfaction problems: ; Example problem: Map coloring, Example problem: Job-shop scheduling, Variations on the CSP formalism, constraint propagation: Inference in csps: Node consistency, Arc consistency, Path consistency, *K*-consistency, Global constraints, Backtracking search for CSPs; Variable and value ordering, Interleaving search and inference, Intelligent backtracking: Looking backward
Textbook-1: Chapter 3: 3.1 to 3.5, Chapter 6: 6.1 to 6.5

UNIT-3 **(08L+4P hrs)**

Concept Learning Introduction, Concept Learning:Well Posed Learning problem, Designing Learning systems, Perspectives and Issues in machine learning, Concept Learning: Introduction, A Concept Learning Task, Concepts Learning Search, Version Spaces and Candidate Elimination Algorithm, Remarks on version space and Candidate Elimination.
Textbook-2: Chapter 2: 2.1 to 2.7

UNIT-4 **(08L+4P hrs)**

Bayesian Learning: Introduction, Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and least squared error hypotheses, Minimum Description Length Principle, Bayes Optimal Classifier, and Naive Bayes Classifier, An Example: Learning to Classify Text,Bayesian Belief network, EM Algorithm- General Statements of EM Algorithm.
Textbook-2: Chapter 6: 6.1 to 6.12

UNIT-5 **(08L+6P hrs)**

Neural Networks: Introduction, Neural Network Representations, Appropriate problems for Neural Networks, Perceptron's, Multilayer Networks and Back Propagation Algorithms.

Reinforcement Learning: Introduction, The learning task, Q-Learning, Nondeterministic rewards and actions, and Temporal difference learning.
Textbook-2: Chapter 4: 4.1 to 4.6, Chapter 13: 13.1 to 13.5

Course outcomes:
On successful completion of this course, students will be able to:

1. Analyse and develop Artificial Intelligent agents for simple applications.
2. Apply searching algorithms to develop Artificial Intelligent agents.
3. Analyse and apply concept learning tasks to solve applications of ML.
4. Apply Bayesian learning for classification problems.
5. Apply neural networks and reinforcement learning concepts to demonstrate applications in ML

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart RusselPeterNorvig	Pearson Education	3rd Edition, 2013/ 4th edition 2020
2	Machine Learning	Tom M Mitchell	McGraw Hill Education	1st Edition, 2017
Reference Books				
1	**Machine Learning**	S. Sridhar, M.vijayalakshmi	Oxford University Press	1th Edition, 2021
2	Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems	AurelienGeron	Shroff/O'Reilly Media	3rd Edition, 2022.
3	Introduction to Machine Learning	EthemAlpaydin	PHI Learning Pvt. Ltd	2nd Edition, 2014.
4	StructuresandStrategiesforComplex ProblemSolving	GeorgeFLuger	Pearson Education	5th Edition, 2011

Lab Syllabus:

Implementation of programs on the following Artificial Intelligence concepts:

1. Agent Programs (simple reflex agents, Goal-based agents)
2. Breadth First Search
3. Depth First Search
4. Best First Search
5. A* Search
6. Constraint Satisfaction Problems (CSPs)
7. Candidate Elimination Algorithm
8. Bayes Theorem
9. Bayesian Belief Network
10. EM Algorithm
11. Back Propagation Algorithm
12. Q-learning
13. Temporal Difference Learning

Course outcomes for lab:
On successful completion of this course, students will be able to:

1. Apply AI techniques to solve search problems.

2. Design and implement searching and CSP problem using C/Python/PROLOG.
3. Implement concept learning tasks to solve applications of ML.
4. Implement Bayesian learning for classification problems.
5. Implement neural networks and reinforcement learning concepts to demonstrate applications in ML

COURSE ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		2											2	
CO2	1		2											2	
CO3		1	2											2	
CO4	1	1												1	
CO5	1		2											2	
Overall CO	1	1	2											2	
PROGRAM ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
Overall CO	1	1	2											2	

B.E COMPUTER SCIENCE AND ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – V

DATA SCIENCE WITH PYTHON LABORATORY

Course Code	**S5CSL01**	CIE Marks	50
TeachingHours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	1	Exam Hours	3
Lecture Hours	-	Practical Hour	26 hrs

Course objectives: The course will enable students to

- Learn how to work with arrays, queries, and data frames.
- Understand the different types of data and the relationships between them, finding the average of a set of data
- Learn how to plot data using Matplotlib and Seaborn in a variety of different plots
- Understand and implement various learning algorithms like regression, classification and clustering.

Sl. no.	Experiments
1	Working with Pandas data frames, perform Data Manipulation operations using Panda's package
2	Working on frequency distribution, Averages and Variability
3	Develop a program for Basic plots using Matplotlib and seaborn/SKL
4	Develop a program for Normal Curves
5	Develop a program for Correlation and scatter plots
6	Develop a program for Correlation coefficient and ROC curves.
7	Develop a program for Simple Linear Regression.
8	Develop a program for Logistic Regression.
9	Develop a program for Multiple regression.
9	Develop a program on decision trees-based on ID-3 Algorithm.
10	Develop a program to implement k-Nearest Neighbour algorithm to classify data set. Print both correct and wrong predictions. (iris Data set can be used)
11	Develop k-Means algorithm for clustering.
12	Develop a program for Agglomerative clustering algorithm.

Note: open ended project on topics covered.

Course outcomes:

On successful completion of this course, students will be able to:

1. Use various Python packages for solving different programming problems.
2. Devise solutions for complex problems of data analysis and machine learning.
3. Evaluate the output of data analysis and machine learning models
4. Implement and analyse various regression algorithms
5. Implement and analyse various classification and clustering algorithms.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered bythe examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 20% Marks is to be deducted.

COURSE ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		2											2	
CO2		1	2											2	
CO3		1	2											2	
CO4		1	2											2	
CO5	1		2											2	
Overall CO	1	1	2											2	
PROGRAM ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
Overall CO	1	1	2											2	

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

COMPILER DESIGN

Course Code	**S5CSPE01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	3	Exam Hours	3
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Introduce the major concept areas of language translation and compiler design.
2. Extend the knowledge of parser by parsing LL parser and LR parser.
3. Evaluate the ideas of intermediate code generation.
4. Use the knowledge gained for generating the code for a typical programming language.

UNIT-1 **(8 hrs)**

INTRODUCTION: Language processors, The structure of a Compiler.
LEXICAL ANALYSIS: The Role of Lexical Analyzer, Lexical Analysis Versus Parsing, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors, Input Buffering, Buffer Pairs, Sentinels, Specification of Tokens, Regular Definitions, Extensions of Regular Expressions. [1.1,1.2, 3.1 to 3.3]

UNIT-2 **(8hrs)**

Lexical Analysis: Recognition of Tokens, Transition Diagrams, Recognition of Reserved Words and Identifiers, Completion of the Running Example, Architecture of a Transition-Diagram-Based Lexical Analyzer.
Syntax Analysis : The role of parser, Representative Grammars, syntax error handling, error recovery strategies, Writing a grammar, lexical versus syntactic analysis, Eliminating ambiguity, Elimination of left-recursion, Left-factoring.
[3.4, 4.1, 4.3.1 to 4.3.4]

UNIT-3 **(8hrs)**

Top-down Parsing: Introduction, Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) grammars , Constructing a predictive parsing table , Non recursive Predictive Parsing, Error Recovery in Predictive Parsing: Panic mode Error Recovery and Phrase level Error Recovery [4.4.1 to 4.4.5]

UNIT-4 **(8hrs)**

Bottom-up Parsing : Reductions, Handle Pruning, Shift-reduce parsing and conflicts during Shift-reduce parsing, Introduction to LR Parsing: Simple LR, Why LR parsers?, Items and LR(0) automaton, Closure of Item Sets, The Function GOTO, LR(0) automaton for the expression grammar, The LR-Parsing Algorithm, Constructing SLR-parsing tables[[4.5.1 to 4.5.4,4.6.1 to 4.6.4]

UNIT-5 **(8hrs)**

Intermediate-code generation: Three-address code – Addresses and instructions, Quadruples and Triples. [6.2.1 to 6.2.3]
Code Generation : Issues in the Design of a Code Generator, Input to the Code Generator, The Target Program, Instruction Selection, Register Allocation, Evaluation Order , The Target Language ,A Simple Target Machine Model , Program and Instruction Costs[8.1 to 8.2]

Course outcomes:

On successful completion of this course, students will be able to:

1. Discuss and Apply the fundamentals of compiler design to construct various components of modern compiler.
2. Discuss functions of lexical analyzer and Design transition diagram based lexical analyzer.
3. Analyze & apply the various forms of context free grammars for the construction of Top down parsers.
4. Design LR (0), SLR (1) parsers by using the LR (0) items.
5. Discuss and Apply the techniques of Intermediate Code Generation and Code generation in the construction of compiler.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Compilers- Principles, Techniques and Tools,	Alfred V Aho, Monica S.Lam, Ravi	Pearson Education	2nd edition, 2013
Reference Books				
1	Compiler Construction Principles & Practice	Kenneth C Louden ,	Thomson Education	1997
2	Modern Compiler Implementation in C	Andrew W Appel	Cambridge University Press,	1st Edition 2010

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3													2	
CO2	2	1												2	
CO3	2	1												2	
CO4			3											2	
CO5	2													2	
Overall CO	3	1	3											2	

Program articulation matrix:

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
Compiler Design	3	1	3	-	-	-	-	-	-	-	-	-	-	2	-

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

SOFTWARE TESTING

Course Code	**S5CSPE02**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Realize the principles of testing and need for testing
2. To understand testing development life cycle
3. Analyse various testing techniques and testing levels
4. Describe various types of test and their objectives
5. Prepare and execute test plan, mange defects and realize the use software matrix.

UNIT-1 **(08 hrs)**

Introduction to testing as an engineering activity, the evolving profession of software engineering, the role of process in software quality, testing as a process.
Testing fundamentals: initiating a study of testing, basic definitions, why testing is necessary? What is testing? The psychology of testing? Software quality assurance group, software-testing principles, the tester's role in a software development organization

UNIT-2 **(08 hrs)**

The test development life cycle (TDLC), when should testing stop?; verification strategies; review, walkthrough, inspection testing types and techniques; white box testing: basis path testing, flow graph notation, cyclomatic complexity, graph matrices, loop testing black box testing: boundary value analysis, equivalence partitioning, graph based testing methods, error guessing.

UNIT-3 **(08 hrs)**

Levels of testing; The Need for Levels of Testing, UNIT Test, UNIT Test Planning, Designing the UNIT Tests. The Class as a Testable UNIT, Running the UNIT tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, System Test – The Different Types, Regression Testing, Alpha, Beta and Acceptance Tests, Web testing: Introduction to web testing, web testing process and techniques, cross browser testing, web browser error messages, Performance testing

UNIT-4 **(08 hrs)**

Test planning: what is test plan; why to plan test? Template for test plan; guidelines for creating the test plan; risk analysis Test design: importance; test design essentials; good test case; test case mistakes; test case template; test design stages; Software Testing Metrics: Why Test Metrics are Important?: Types of Test Metrics Manual Test Metrics; Test Metrics Life Cycle; How to calculate Test Metric;Test Strategy;Test Plan Vs Test Strategy

UNIT-5 **(08 hrs)**

Test execution: Objectives; execution considerations; execution activities
Defect management: what is defect; defect life cycle; defect management process
Test matrix, Test strategy document, Tools support for testing, Test tool considerations, Effective use of tools,Introduction to automation testing, Need for automation, Hands-on Selenium tool.

Course outcomes:

Upon completion of this course the student will be able to:

1. Identify the need and the importance of software testing as an engineering activity
2. Interpret the concept of testing using different types of testing and testing techniques.
3. Identify the different levels of testing.
4. Demonstrate the test plans and test cases.
5. Interpret the defect management process

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	"Practical Software Testing"	Ilene Burnstein	Springer international edition	2003 1st edition (UNIT-I)
2	Foundations of Software Testing ISTQB certification (Level I)	Dorothy graham, Erik van veenendaal, Rex black,	Cengage Publications	3rd edition
3	"Managing the Software Process	Watts Humphrey	Addison Wesley	1st edition.
Reference Books				
1	"Software System Testing And Quality Assurance"	Boris Beizer	Van Nostrand Reinhold	1st edition
2	"Zero Defect Software"	Gordon schulmeyer	McGraw-Hill	1st edition

WEB LINKS:

1.	https://www.coursera.org/specializations/software-testing-automation
2.	https://www.udemy.com/course/everything-for-software-tester/
3.	https://www.udacity.com/course/software-testing--cs258
4.	https://www.greatlearning.in/academy/learn-for-free/courses/software-testing-fundamentals1
5.	https://www.guru99.com/software-testing.html
6.	https://onlinecourses.nptel.ac.in/noc19_cs71/preview
7.	https://testinginstitute.com/Free-Software-Testing-Training.php

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	2				2			2						2
CO2		2				2			2			2			2
CO3		2				2			2						2
CO4		2							2	2		2			2
CO5		2				2			2						2
Overall CO	2	2				2			2	2		2			2

Program articulation matrix:

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
	2	2	2			2			2	2		2			2

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

COMPUTER GRAPHICS AND IMAGE PROCESSING

Course Code	**S5CSPE03**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Demonstrate basic understanding of the core concepts of computer graphics
2. Develop programs using OpenGL to achieve visualization in graphical applications
3. Apply engineering knowledge to develop 2D & 3D projections for visualization
4. Apply techniques like rasterization, clipping, hidden surface removal and anti-aliasing for graphical applications
5. Demonstrate use cases using opencv

UNIT-1 **(08 hrs)**

Introduction: Applications of computer graphics, A graphics system, Images: physical and Synthetic, Imaging systems, The Synthetic camera model, Graphics architectures, Graphics programming: the Sierpinski gasket, Programming 2D applications

UNIT-2 **(08 hrs)**

The OpenGL: The OpenGL API, Primitive and attributes, control functions, the Gasket program, Polygons and recursion, The 3D gasket, Plotting implicit functions

UNIT-3 **(08 hrs)**

Input and Interaction: input devices, Display lists: display lists & modeling, Programming event_driven input, Menus: picking: A simple CAD program; Building interactive models, Animating interactive programs;

UNIT-4 **(08 hrs)**

Implementation: Basic implementation strategies, the major tasks, Clipping, line_segment clipping, polygon clipping, Clipping of other primitives, Rasterization, Bresenham's algorithm, Polygon Rasterization, Hidden surface removal, Antialiasing

UNIT-5 **(08 hrs)**

Three.js: A 3D Scene Graph API: Three.js Basics: About JavaScript UNITs, Scene, Renderer, Camera, THREE.Object3D, Object, Geometry, Material, Lights, A Modeling Example, Building Objects: Polygonal Meshes and IFSs, Curves and Surfaces, Textures, Transforms, Loading Models

Course outcomes:

Upon completion of this course the student will be able to:

1. Apply knowledge of graphics concepts, architecture and programming in developing graphical applications.
2. Create, select and apply appropriate OpenGL functions, 2D and 3D projections to achieve visualization in graphics designing.
3. Analyze and develop interactive, animated and event driven graphical solutions with OpenGL

4. Analyze and apply the different implementation techniques like rasterization, clipping, hidden surface removal and antialiasing
5. Apply basics of computer graphics to get insight into digital image processing

Sl. no.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Interactive Computer Graphics A Top-Down Approach with OpenGL,	Edward Angel	Addison-Wesley"	,5th Edition, ,2008(UNITs 1,2 3 4))
2	Introduction to Computer Graphics,	David J. Eck		version 1.4,2023(UNIT 5)
Reference Books				
1	Computer Graphics Using OpenGL,.	F.S. Hill,Jr.	Pearson education	2nd Edition, 2001
2	Computer Graphics,	James D Foley, Andries Van Dam,	Addison-Wesley.	1997
3	Computer Graphics with OpenGL,	Donald Hearn and	,Pearson Education	4th edition, 2011

Course Articulation matrix(CO-PO and CO-PSO mapping)

COURSE ARTICULATION MATRIX														
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		2											2	
CO2			3											2	
CO3			3											2	
CO4			3											2	
CO5	1		3											2	
Overall CO	1		3												

B.E CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

INFORMATION RETRIEVAL

Course Code	**S5CCSPE01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

- Identify the Information Retrieval problems and describe the architecture of a search engine
- Analyse Search structures of dictionaries, Wildcard queries and Index construction done information retrieval
- Analyse the scoring and ranking mechanisms used in Information retrieval systems
- Study the various Information Retrieval Evaluation Techniques and processes involved.
- Study how web search, web crawling and link analysis is done for information retrieval on the web

UNIT-1 **7 Hours**

Introduction

Search Engines and Information Retrieval : What Is Information Retrieval? , The Big Issues, Search Engines, Search Engineers

Architecture of a Search Engine: What Is an Architecture? ,Basic Building Blocks ,Breaking It Down, Text Acquisition Text Transformation , Index Creation, User Interaction, Ranking ,Evaluation, How Does It Really Work?

Boolean retrieval: An example information retrieval problem , A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval

Vocabulary and postings lists: Document delineation and character sequence decoding: Obtaining the character sequence in a document, Choosing a document UNIT

Determining the vocabulary of terms: Tokenization, Dropping common terms: stop words, Normalization (equivalence classing of terms), Stemming and lemmatization, Faster postings list intersection via skip pointers

Positional postings and phrase queries: Biword indexes, Positional indexes, Combination schemes

UNIT-2 **7 Hours**

Dictionaries and tolerant retrieval

Search structures for dictionaries, Wildcard queries: General wildcard queries , k-gram indexes for wildcard queries , Spelling correction: Implementing spelling correction, Forms of spelling correction, Edit distance, k-gram indexes for spelling correction, Context sensitive spelling correction, Phonetic correction.

Index construction :

Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing

Index Compression:

Dictionary Compression, Dictionary as a string, Blocked storage., Postings file compression: Variable byte codes, γ codes

UNIT-3 **7 Hours**

Scoring, term weighting and the vector space model : Parametric and zone indexes : Weighted zone scoring , Learning weights, The optimal weight g, Term frequency and weighting: Inverse document frequency , Tf-idf weighting , The vector space model for scoring: Dot products, Queries as vectors, Computing vector scores, Variant tf-idf functions: Sublinear tf scaling, Maximumtf normalization, Document and query weighting schemes, Pivoted normalized document length

Computing scores in a complete search system

Efficient scoring and ranking: Inexact top K document retrieval, Index elimination, Champion lists, Static quality scores and ordering, Impact ordering, Cluster pruning.

Components of an information retrieval system: Tiered indexes, Query-term proximity, Designing parsing and scoring functions, Putting it all together , Vector space scoring and query operator interaction

UNIT-4 **9 Hours**

Evaluation in information retrieval:

Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance : Critiques and justifications of the concept of relevance , A broader perspective-System quality and user utility: System issues, User utility, Refining a deployed system, Results snippets.

XML retrieval:

Basic XML concepts , Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

Language models for information retrieval :

Language models: Finite automata and language models, Types of language models, Multinomial distributions over words , The query likelihood model: Using query likelihood language models in IR, Estimating the query generation probability, Ponte and Croft's Experiments**,** Language modelling versus other approaches in IR, Extended language modelling approaches

Understanding Large Language Models, Retrieval: The Role of Large, Language Models in a Post-Search

Engine Era

UNIT-5 **9 Hours**

Web search basics : Background and history

Web characteristics: The web graph, Spam,Advertising as the economic model, The search user experience: User query needs, Index size and estimation, Near-duplicates and shingling

https://www.youtube.com/watch?v=DkspjZRYD8s

Web crawling and indexes:

Overview: Features a crawler must provide, Features a crawler should provide, Crawling: Crawler architecture: DNS resolution, The URL frontier, Distributing indexes, Connectivity servers

Link analysis:

The Web as a graph: Anchor text and the web graph, PageRank: Markov chain, The PageRank computation, Topic-specific PageRank , Hubs and Authorities: Choosing the subset of the Web.

Course outcomes:

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

CO1: Analyse the Information Retrieval problems and describe the architecture of a Search Engine

CO2: Apply Search structures of dictionaries, Wildcard queries and Index construction for information retrieval.

CO3: Apply scoring and ranking mechanisms to design an efficient Search Engine

CO4: Apply suitable evaluation techniques and language models in the design of Search Engine

CO5: Analyse web search, web crawling and link analysis mechanisms for information retrieval on the web

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Introduction to Information Retrieval	C. Manning, P. Raghavan, and H. Schutze, 2008.	Cambridge University Press	1st Edition, 2009
2	Search Engines: Information Retrieval in Practice	Bruce Croft, Donald Metzler and Trevor Strohman	Addison Wesley	2nd Edition, 2015
3	Build a Large Language Model (From Scratch) https://livebook.manning.com/book/build-a-large-language-model-from-scratch/chapter-1/v-2/ https://www.manning.com/books/build-a-large-language-model-from-scratch	Sebastian Raschka; C. Manning	Manning Books	MEAP August 2024
	Additional Resource : https://medium.com/@daniele.nanni/revolutionizing-information-retrieval-the-role-of-large-language-models-in-a-post-search-engine-7dd370bdb62			
Reference Books				
1	Modern Information Retrieval: The Concepts and Technology behind Search	Ricardo Baeza - Yates and Berthier Ribeiro - Neto	ACM Press	2nd Edition, 2011
2	Information Retrieval Implementing and Evaluating Search Engines	Stefan Buttcher Charles L. A. Clarke Gordon	MIT Press	1st Edition, February 2016

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		2												2	
CO2	2													2	
CO3			2											2	
CO4			2											2	
CO5		2												2	
Overall CO	2	2	2											2	

B.E COMPUTER SCIENCE & ENGINERRING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – V

ENVIRONMENTAL SCIENCE

Course Code	SHS06	CIE marks	50
L/ T/ P	(2:0:0)	SEE Marks	50
Credits	2	Duration SEE (Hrs)	2
Lecture Hours	26 Hrs	Practical Hour	-

Course Objectives:

1. The problems of depletion of natural resources due to deforestation, agricultural practices, and adverse environmental effects, pesticides, soil erosion, mining.
2. Different types of energy- renewable, non-renewable and energy conservation, impact of environmental pollution, solid waste management - disposal, treatment of different types of solid waste including MSW and e-waste.
3. Societal impacts of environmental issues - ozone layer depletion, GHG effects, and water conservation.

UNIT 1 (3hrs)

Introduction: • Components of Environment and their interactions

Natural Resources:

• Forest Resources - Deforestation, Causes of deforestation, Environmental effects of deforestation and solutions

• Water resources, Types of water reserves

• Land resources, Land degradation. Soil erosion, Causes and prevention, Soil conservation and its types.

UNIT 2 (3hrs)

Energy and resources:

• Types of Energy - Renewable, Non-renewable & sustainable energy & their advantages and disadvantages

• Renewable energy sources - Solar energy, Wind energy, Biomass energy, Thermal power - environmental impacts, Hydrogen energy

• Tips for conservation of energy

UNIT 3 (3Hrs)

Environmental pollution:

• Sources of pollution- Natural and anthropogenic sources

• Pollutants - Classification & their effects on environment

• Air Pollution -Composition of clean air, Sources of air pollution, Effect of air pollution on human health and climate

• Water quality – Potable water, Wholesome water, Sources of water pollution

• Common impurities in water, Effects of impurities on human health

• Soil Pollution – Sources, effects and its control

UNIT 4 (3 Hrs

Solid Waste Management:

• Definition of solid waste, refuse, garbage, rubbish, ash. Types of solid waste
• Municipal solid waste and the necessity of its safe disposal, Impacts on human health and environment
• Quantity and composition of MSW
• Disposal of solid waste
• E-waste – Types and health effects

UNIT 5 (3 Hrs)

Sustainable development

• Global environmental issues: Population growth, Urbanization, Global warming, Acid rains, Ozone layer depletion & controlling measures
• Issues on energy utilization, water conservation, concept of 3 Rs, Rainwater harvesting - methods

Course Outcomes:

	After completion of the course, the student will be able to -
CO1	Describe the interactions between components of environment, importance of water and land resources, effects of deforestation and land degradation
CO2	Describe the need for renewable sources to address the present world's energy demand
CO3	Describe the effects of pollution of air, water, soil, and its control
CO4	Describe the composition of solid waste, its impact on environment and its safe disposal
CO5	Describe the current environmental issues, the need for sustainable development, and its importance in the present world

Question paper pattern:

The question paper pattern for CIE and SEE is as follows:

Test 1	25 Marks	45 Minutes	• 10 Marks (Multiple Choice Questions) • 3 Descriptive Questions of 5 Marks each
Test 2	25 Marks	45 Minutes	
SEE	50 Marks	90 Minutes	• 20 Marks (Multiple Choice Questions) • 30 Marks (Descriptive Questions of 6 Marks each)

Sl.No	Title of the Book	Author/s	Publisher	Year
T1	Joseph, B. (2009). Environmental Studies. India: Tata McGraw-Hill. ISBN: 9781283922524			
T2	Tripathi, A. K. (2016). Environmental Studies. India: Energy and Resources Institute. ISBN:9788179935828			
R1	Akitsu, T. (2018). Environmental Science: Society, Nature, and Technology. Singapore: Jenny Stanford Publishing. ISBN: 9780429468230			

Course articulation matrix					NHS05			Environmental Science							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							M								
CO2							M								
CO3							M								
CO4							M								
CO5							M								

B B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

Research Methodology and IPR

Course Code	S5IMA01	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	3	Exam Hours	3
Lecture Hours	40 hrs	Practical Hour	-

UNIT 1 **6 Hours**

RESEARCH METHODOLOGY: Objectives and motivation of research - Types of research - Research approaches - Significance of research - Research methods verses methodology - Research and scientific method - Importance of research methodology - Research process - Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations- Criteria of good research. Defining the research problem: Definition of research problem - Problem formulation - Necessity of defining the problem - Technique involved in defining a problem.

UNIT 2 **5 Hours**

LITERATURE SURVEY AND DATA COLLECTION: Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Effective literature studies approaches, analysis, plagiarism, and research ethics. Data - Preparing, Exploring, examining and displaying.

UNIT 3 **5 Hours**

RESEARCH DESIGN AND ANALYSIS: Meaning of research design - Need of research design - Different research designs - Basic principles of experimental design - Developing a research plan - Design of experimental set-up - Use of standards and codes. Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT 4 **8 Hours**

INTELLECTUAL PROPERTY RIGHTS (IPR): Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Role of WIPO and WTO ni IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT 5 **8 Hours**

PATENT RIGHTS (PR): Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs. Licenses, Licensing of related patents, patent agents, Registration of patent agents.

Course outcomes:

On successful completion of this course, students will be able to:

1. Describe the research process & formulate research problem
2. Perform literature review, manage data & practice research ethics
3. Practice basic principles of experimental design, use standard codes and carry out research analysis
4. Distinguish between types of innovation, describe patenting procedure, maintenance and role of IPR establishments
5. Identify the significance of patent rights, licensing, technology transfer & manage patenting system

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		3	2									2				
CO2		3	2					3				2				
CO3		3	3									2				
CO4		3	2									2				
CO5		3	2									2				

Text Books:

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Peter S. Menel Mark A. Lemley, Robert P. Merges	"Intellectual Property in the New Technological-Vol. I Perspectives, 2021.
2.	Laura R. Ford	"The Intellectual Property of Nations: Sociological and Historical Perspectives on a Modern Legal Institution Paperback -2021.

Reference Book:

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	R. Ganesan	"Research Methodology for Engineers", MJP Publishers, Chennai, 2011.
2.	Cooper Donald R, Schindler Pamela S and Sharma JK	"Business Research Methods", Tata McGraw Hill Education, 11th Edition, 2012.
3.	Catherine J. Holland	"Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
4.	David Hunt, Long Nguyen, Matthew Rodgers	"Patent searching: tools &techniques", Wiley, 2007.
5.	The Institute of Company Secretaries of India, Statutory body under an Act of parliament	"Professional Programme Intellectual Property Rights, Law and practice", September 2013.

Scheme of Teaching, Examination and Syllabus

B.E. COMPUTER SCIENCE & ENGINEERING

Batch: 2022-23

VI SEMESTER

(Effective from the academic year 2024-2025)

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

COMPUTER NETWORKS (I)

Course Code	S6CSI01	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	04	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	26 hrs

Course objectives: The course will enable students to

1. Understand the basic networking concepts and layers of TCP/IP model.
2. Interpret Line coding, error detection and correction techniques and access protocols.
3. Understand routing algorithms, congestion control and resource allocation.
4. Introduces internetworking and describes the key elements of the IP.
5. Analyse the transport-layer concepts: Transport-Layer services Reliable vs. un-reliable data transfer -TCP protocol -UDP protocol and QoS.

UNIT-1 **(08L+ 4P hrs)**

TCP/IP Protocol Suite, Layered Architecture, Layers in the TCP/IP Protocol Suite, Description of Each Layer, Encapsulation and Decapsulation, Addressing, Multiplexing and De-multiplexing.

Data Rate Limits: Noiseless Channel: Nyquist Bit Rate, Noisy Channel: Shannon Capacity .Digital-To-Digital Conversion: Line Coding, Line Coding SchemesAnalog-To-Digital Conversion: Pulse Code Modulation (PCM)

Cyclic Codes: Cyclic Code Encoder Using binary and PolynomialsMedia Access Control (Mac)**:**CSMA, CSMA/CD, CSMA/CA.

Section: 2.2, 3.5, 4.1(4.1.1, 4.12), 4.2(4.2.1), 10.3 (10.3.1 to 10.3.3), 12.1 (12.1.2 to 12.1.4)

UNIT-2 **(08L+ 4P hrs)**

Network Layer: Network-Layer Services: Packetizing, Routing and Forwarding Network-Layer Performance: Delay, Throughput, Packet Loss. Congestion Control.

IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT).

Internet Protocol (IP): Datagram Format, Fragmentation, Security of IPv4 Datagrams.

Section:18.1, 18.3, 18.4, 19.1

UNIT-3 **(08L+ 6P hrs)**

Unicast Routing: Introduction: General Idea, Least-Cost Routing.

Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing.

Next Generation IP: IPv6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration.

The IPv6 Protocol: Packet Format, Extension Header, Transition from IPv4 To IPv6: Strategies.

Section:20.1, 20.2, 22.1, 22.2, 22.4

UNIT-4 **(08L+ 6P hrs)**

Transport Layer Protocols: Introduction: Services, Port Numbers.

User Datagram Protocol: User Datagram, UDP Services, UDP Applications.

TransmissionControl Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control (except Sender and Receiver FSMs), TCP Congestion Control.

Section:24.1, 24.2, 24.3 (24.3.1 to 24.3.9)

UNIT-5 **(08L+ 6P hrs)**

World Wide Web and HTTP: World Wide Web. Hypertext Transfer Protocol (HTTP), SMTP protocol, DNS: Name Space and Resolution, Telnet.

Quality Of Service: Data-Flow Characteristics: Definitions, Sensitivity of Applications, Flow Classes. Flow Control To Improve QoS; Scheduling, Traffic Shaping or Policing, Resource Reservation, Admission Control. Integrated Services (Intserv): Flow Specification, Admission, Service Classes. Resource Reservation Protocol (RSVP), Problems with Integrated Services.

Differentiated Services(DFFSERV): DS Field, Per-Hop Behaviour, Traffic Conditioners.

Section:26.1, 26.3, 26.4, 26.6, 30.1, 30.2, 30.3,30.4

LAB COMPONENT

Week 1:Study of basic Linux networking commands:1)ifconfig , 2) ip, 3) tracepath, 4) ping, 5) netstat, 6) ss, 7) dig, 8) nslookup, 9) route, 10) host, 11) arp, 12) hostname13) Wget, 14) Curl

Week 2: Basic experiments in CISCO packet tracer

1.Connecting Two PCs in Cisco Packet

2.Connecting Two Different Networks using Router,

3.Swtich configuration

4. DHCP Configuration

Week 3: Wireshark packet analysis for the following network protocols:

Hypertext Transfer Protocol, Domain Name Server, TCP, UDP, IP, ICMP and DHCP

Week 4: onwards in every lab the instructions of the following experiments to be taught during the first 30 min of the lab. The remaining one and hour half is to be utilized in conducting the experiments and verification of the results.

1. Write a program for error detecting code using 16 bits CRC-CCITT (Consultative Committee for International Telephony and Telegraphy).

2. Write a program to divide the message into variable length frames and sort them and display the message at the receiving side.

3. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare the throughput.

4. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

5. For the given network graph, write a program to implement Link state routing algorithm to build a routing table for the given node.

6. Using FIFOs as IPC channels, write a client – server program, the client sends the file name and theserver sends back the requested text file if present.

7.Using TCP/IP sockets, write a client – server program, the client sends the file name and the server sends back the requested text file if present.

8.Using UDP, write a client – server program, to exchange messages between client and the server

9.Simulate the different types of Internet traffic such as FTP and TELNET over a network and analyze the throughput.

10.Simulate simple ad-hoc network with transmitting nodes and determine the performance with respectto transmission of packets.

Course outcomes:

On successful completion of this course, students will be able to:

1. Apply the basics of computer networks technology and analyse the concepts of Digitaltransmission, error control protocols and random access protocols.
2. Apply the knowledge of Packet switching concepts in computer networking, Identify differentcategories of IP addresses and design subnets.
3. Analyse different Unicast routing mechanisms and protocols.
4. Analyse the transport-layer concepts and services -unreliable vs. reliable data transfer.
5. Examine various network protocols and Appraise existing QoS and application layer protocol/s.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Communications and Networking	Behrouz A. Forouzan	McGraw-Hill	5thEdition, 2013
2	Computer Networks: A Systems Approach	Larry L Peterson and	Elsevier	5th Edition, 2011
Reference Books				
1	Data and Computer Communications	William Stallings	Pearson Education	10th Edition, 2013
2	Computer Networking: A Top-Down Approach	Kurose James F, Ross Keith W.	Pearson Education	6th Edition, 2017
3	Computer Networks	Andrew S. Tanenbaum and David J.	Pearson Education	5th Edition,2011
4	Unix Network Programming, Interprocess Communications,	W Richard Stevens	Pearson Education	2nd Edition

COURSE ARTICULATION MATRIX (CO-PO AND CO-PSO MAPPING):

COURSE ARTICULATION MATRIX														
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2														2
CO2	2		3												3
CO3		2													2
CO4		2													2
CO5	2	2													2
Overall CO	2	2	3						2	2					3

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

INTERNET OF THINGS

Course Code	S6CS01	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	04	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	26 hrs

Course objectives: This course will enable students to:

1. To identify sensors, actuators, and the importance of IoT Processing technologies
2. To determine salient features, technologies, requirements associated with IoT connectivity and IoT communication protocols
3. To apply security principles for securing Operational and Informational Technology (OT and IT) in IoT environment
4. To synthesize IoT generated data, IoT Cloud based services, data storage and IoT vulnerabilities
5. To apply the knowledge in real time by learning the case studies of IoT

UNIT-1 **(07 hrs)**

IoT Sensing and Actuation: Sensors, Sensor characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuators Types, Actuator Characteristics
(Text Book 1: Chapter 5)
IoT Processing Topologies and Types: Data Format, Importance and processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading
(Text Book 1 : Chapter 6)

UNIT-2 **(08 hrs)**

IoT Connectivity Technologies: IEEE 802.15.4, Zigbee, Thread, ISA 100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRA, NB-IoT, Wifi, Bluetooth
(Text Book 1: Chapter 7)
IoT Communication Technologies: Infrastructure Protocols – Internet Protocol version 6, 6LowPAN, QUIC, Micro Internet Protocol, Nano Internet Protocol, Data Protocols – MQTT, MQTT-SN, CoAP, AMQP, XMPP, SOAP, REST, WebSocket Identification Protocols.
(Text Book 1: Chapter 8)

UNIT-3 **(08 hrs)**

IoT Application Transport Methods: Application Layer not present, SCADA, Generic Web based Protocols, IoT Application Layer Protocols (Text Book 2: Chapter 6)
Securing IoT: Common Challenges in OT Security – Erosion of Network Architecture, Pervasive Legacy Systems, Insecure Operational Protocols, Other Protocols, Device Insecurity, Dependence on External Vendors, How IT and OT Security Practices and Systems vary, Formal Risk Analysis Structures: OCTACE and FAIR, The Phased Application of Security in an Operational Environment
(Text Book 2: Chapter 8)

UNIT-4 **(08 hrs)**

Data Analytics for IoT: Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real time Data Analysis
(Text Book 3 – Chapter 10)

UNIT-5 **(08 hrs)**

Case Studies for IoT:
Agricultural IoT (Text Book 1: Chapter 12)
Vehicular IoT (Text Book 1: Chapter 13)
Health Care IoT(Text book 1: Chapter 14)
Paradigms, Challenges and Future: Evolution of new IoT paradigms, Challenges Associated with

IoT, Emerging pillars of IoT (Text book 1: Chapter 15)

Course outcomes:

On successful completion of this course, students will be able to:

1. To Characterize sensors, actuators, their associated multi-faceted considerations and to determine the importance of IoT Processing technologies
2. To identify, understand and determine salient features, technologies, requirements associated with IoT connectivity and IoT communication protocols
3. To apply the transport methods and handling of IoT application data; To synthesize the principles of securing Operational and Informational Technology (OT and IT)
4. To synthesize data analytics for IoT
5. To analyze the application of IoT in agriculture, vehicles and health care and to learn the future trends of IoT

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Big Data Black Book	D T Editorial Services	Dreamtech press	2016 Edition
2	Spark in Action	PetarZečević Marko Bonaći	Manning Publications	Nov 2016 Edition
Reference Books				
1	Big Data Glossary	Pete Warden	O'Reilly	2011
2	Hadoop: The Definitive Guide	Tom White	O'reilly Media	4th Edition,2015
3	Big Data and Analytics	SeemaAcharya,SubhashiniChellappan	Wiley India Publications,	May 2015

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2														2
CO2		2													2
CO3		2													2
CO4		2													2
CO5		2							2	2					2
Overall CO	2	2							2	2					2

Program articulation matrix:

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
	2	2							2	2					2

Degree of compliance **1**: Low **2**: Medium **3**: High

B.E ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - VI

INTERNET OF THINGS LABORATORY

Sl. No.	Experiments
	LAB SET QUESTIONS
1.	To interface LED/buzzer with Arduino and write a program to control lights (min 3 LED's) and turn the buzzer ON when all lights turned ON.
2.	Experiment to interface IR/LDR with Arduino and write a program to control IR sensor and turn LED on when the push button is pressed
3.	Experiment to interface temperature sensor DHT11 and write a program to print the temperature and humidity reading. Turn the LED and buzzer ON when the temperature threshold reaches beyond 35 degrees.
4.	Experiment to interface servo motor using Arduino. Control the positional reading through switch and add the indicators using buzzer.
5.	To interface Bluetooth with Arduino and write a program to send sensor data to smartphone using Bluetooth.
6.	To interface GPS UNIT with Arduino and write a program to send location data to smartphone
7.	Control light through Voice command using Arduino
8.	Set up a simple web server using ESP32 UNIT and monitor the live temperature in the web browser
9.	ABL - Open ended project

Revised Bloom's Taxonomy Level	L_2 - Understanding, L_3 - Applying

Course outcomes:

On successful completion of this course, students will be able to:

1. Discover key IoT concepts including identification, sensors, localization, wireless protocols, data storage and security
2. Explore IoT technologies, architectures, standards, and regulation
3. Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices

Program Articulation Matrix

Course Outcomes	Program Outcomes												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2													2
CO2		2													2
CO3		2													2
CO4		2													2
over all		2													2

Degree of compliance 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

B.E COMPUTER SCIENCE & ENGINERRING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – VI

HIGH PERFORMANCE COMPUTING

Course Code	**S6CSPE01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	3	Exam Hours	3
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: The course will enable students to

1. To analyse typical parallel algorithm models and its application in scientific computing. (Analysis, Application)
2. To develop programs using message-passing paradigm. (Synthesis)
3. To learn how GPUs works using the CUDA architecture and its applications (Comprehension, Application)
4. To gain practical knowledge by giving hands on experience inGraphics Interoperability, CUDA C on multiple GPUs and CUDA toolkit (Synthesis)
5. To analyze the latest parallel computing techniques and research - prepare a technical document and make a presentation (Analysis, Syntheses and Evaluation)

To develop open ended solution for any of the identified high performance computing problems

UNIT 1 **8 Hours**

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions,Mapping Techniques for Load Balancing ,

Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction , All-to-All Broadcast and Reduction

Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs(5.1) , the Effect of Granularity on Performance.

UNIT 2 **7 Hours**

Programming Using the Message-Passing Paradigm:

Principles of Message-Passing Programming , The Building Blocks: Sendand Receive Operations , MPI: the Message Passing Interface

UNIT 3 **8 Hours**

Programming Shared Address Space Platforms:

Thread Basics , Why Threads? , The POSIX Thread API,Thread Creation and Termination, Synchronization Primitives in Pthreads ,Controlling Thread and Synchronization Attributes , Thread Cancellation,Composite Synchronization Constructs, OpenMP: a Standard for Directive Based Parallel Programming

UNIT 4 **8 Hours**

Why CUDA? Why Now?: The Age of Parallel Processing, Central Processing UNITs,The Rise of GPU Computing, A brief history of GPUs, Early GPU computing, CUDA,What is CUDA architecture, using the CUDA architecture, Applications of CUDA,Medical Imaging, Computational Fluid Dynamics, Environmental Science, Introductionto CUDA C: A First Program, Hello world, A kernel call, Passing parameters, Queryingdevices, using device properties, Parallel Programming in CUDA C:CUDA parallel programming, Summing vectors, A fun example.

UNIT 5 **8 Hours**

Graphics Interoperability: Graphics Interoperation, GPU Ripple with Graphics Interoperability - the GPUAnimBitmap structure; GPU Ripple Redux , Heat transfer with Graphics Interop, DirectX Interoperability

CUDA C ON multiple GPUS : Zero-Copy Host Memory -Zero-Copy Dot Product; Zero-Copy Performance, Using Multiple GPUs, Portable Pinned Memory

CUDA Tools: CUDA Toolkit- CUFFT, CUBLAS, NVIDIA GPU Computing SDK, Debugging CUDA C

Topics for Open Ended Activity :
Self Learning component

Parallel Computing models, parallel virtual machines and usage, Data-Parallel Algorithms, Graphics Interoperability, Parallel Computing Strategies, Linear Algebra Image/Video Processing computation, Data Compression, Physically-Based Simulation, Parallel pragma/directive based frameworks, Usage and Performance analysis and comparisons– FPGA, GPUs, GP-GPUS, CPU-GPUs, Analysis of HPC Benchmark Suite/Tools/Solutions/Standard etc, and so on.

Course outcomes:

On successful completion of this course, students will be able to:

1. Select and analyze the characteristics of various parallel computing platforms.

2. Choose a suitable platform for parallel computing.

3. Analyze simple parallel algorithm models.

4. Apply the principles of message-passing programming construct to solve engineering problems.

5. Design and develop parallel programs using CUDA and OpenMp programming interface

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to parallel computing (chapters 01,2.1-2.5,3,4.1.1-4.1.3, 5.1, 5.2, 5.3, 6,7)	Ananth Grama,AnshulGupta,Vipinkumar,GeorgeKarypis	Pearson education publishers	second edition, 2015
2	CUDA by example (Chapters 1 ,3, 4, 5, 8, 11, 12)	Jason Sanders Edward Kandrot	NVIDIA Corporation	2015
Reference Books				
1	Parallel Programming for Multicore and cluster systems	Thomas Rauber and GudulaRunger	Springer	International Edition,2009
2	Introduction to Parallel Computing	Niranjan N. Chiplunkar, Raju K	Wiley	2020

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2												2		
CO3		2											2		
CO4			2		2								2		
CO5			2		2								2		
Overall CO	2	2	2		2								2		

B.E COMPUTER SCIENCE & ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – VI

BLOCKCHAIN TECHNOLOGY

Course Code	**S6CSPE02**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. Describe the fundamentals of Blockchain and its organization.
2. Analyse the underlying concepts of working of a Blockchain.
3. Analyse the working principles of Bitcoin.
4. Analyse the working of Blockchain on Ethereum platform
5. Identify and explore possible business applications of Blockchain.

UNIT-1 **(08 hrs)**

Introduction to Blockchain, Backstory of Blockchain, What is Blockchain?, Centralized vs. Decentralized Systems, Centralized Systems, Decentralized Systems, Layers of Blockchain, Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer, Why is Blockchain Important?, Limitations of Centralized Systems, Blockchain Adoption So Far, Blockchain Uses and Use Cases

T1 – Chapter 1

How Blockchain Works: Laying the Blockchain Foundation, Cryptography: Symmetric Key Cryptography, Cryptographic Hash Functions,MAC and HMAC,Asymmetric Key Cryptography, Diffie-Hellman Key Exchange,Symmetric vs. Asymmetric Key Cryptography.

T1 – Chapter 2

UNIT-2 **(08 hrs)**

Game Theory: Nash Equilibrium, Prisoner's Dilemma, Byzantine Generals' Problem, Zero-Sum Games, Why to Study Game Theory,

Computer Science Engineering, The Blockchain, Merkle Trees,

Putting It All Together, Properties of Blockchain Solutions, Blockchain Transactions, Distributed Consensus Mechanisms, Blockchain Applications, Scaling Blockchain, Off-Chain Computation, Sharding Blockchain State

T1 – Chapter 2

UNIT-3 **(08 hrs)**

The History of Money, Dawn of Bitcoin, What Is Bitcoin?, Working with Bitcoins, The Bitcoin Blockchain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation, Putting It all Together, Bitcoin Scripts, Bitcoin Transactions Revisited, Scripts, Full Nodes vs. SPVs, Full Nodes, SPVs

T1 – Chapter 3

UNIT-4 **(08 hrs)**

From Bitcoin to Ethereum, Ethereum as a Next-Gen Blockchain, Design Philosophy of Ethereum, Enter the Ethereum Blockchain, Ethereum Blockchain, Ethereum Accounts, Trie Usage, Merkle Patricia Tree, RLP Encoding, Ethereum Transaction and Message Structure, Ethereum State Transaction Function, Gas and Transaction Cost, Ethereum Smart Contracts, Contract Creation, Ethereum Virtual Machine and Code Execution, Ethereum Ecosystem, Swarm, Whisper, DApp, Development Components

T1 – Chapter 4

UNIT-5 **(08 hrs)**

Propelling Business with Blockchains , Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business Networks, Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility, Blockchain in Action: Use Cases Financial Services, Trade finance, Post-trade clearing and settlement, Cross-border transactions, Trusted digital identity, Multinational Policy Management, Government, Supply Chain Management, Food safety, Global trade, Healthcare, Electronic medical records, Healthcare payment preauthorization

T2 – Chapter 3 & 4

Course outcomes:

On successful completion of this course, students will be able to:

1. Apply the knowledge of Cryptography and distributed systems to describe the concepts of Blockchain, its structure and working.
2. Apply the knowledge of Data structures and Game theory to describe the processing of blockchain transactions and consensus mechanisms.
3. Analyse the working of Bitcoin crypto currency with the associated scripts and infrastructure
4. Describe the working of Ehereum blockchain and develop a suitable application on Ethereum blockchain platform
5. Identify potential business use cases of Blockchain in various sector and analyse its impact.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Beginning Blockchain ISBN 9781484234433	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	Apress Media	2018
2	Manav Gupta	Blockchain For Dummies,	John Wiley & Sons,	2nd IBM Limited Edition
Reference Books				
1	Blockchain for Business 2019	Peter Lypovonyav	Packt Publishing Limited,	2019
2	Ethereum for Architects and Developers	Debajani Mohanty	Apress Media, 2018, ISBN 9781484240748	2018
3	Regulating Blockchain Techno-Social and Legal Challenges	Philipp Hacker, Ioan nis	Oxford University Press, ISBN: 9780198842187	2019

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2													2	
CO2	2													2	
CO3		2												2	
CO4			2		2									2	
CO5		2												2	
Overall CO	2	2	2		2									2	

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

CLOUD COMPUTING

Course Code	S6CCSPE01	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	100
Credits	3	Exam Hours	3
Lecture Hours	40hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Learning about cloud types, paradigm shift in cloud computing, attributes that make the cloud computing unique, SLA and licencing.
2. Understanding architecture and infrastructure of fog computing cloud computing including SaaS, PaaS and IaaS.
3. Understanding various types of virtualization and learning about the capacityplanning for the cloud.
4. Understanding how cloud data can be secured.

UNIT-1 **(7 hrs)**

Defining Cloud Computing: Cloud Types, The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing; Assessing the value proposition: Early adopters and new applications, the laws of cloud economics, cloud computing obstacles, behavioural factors relating to cloud adoption, measuring cloud computing costs, specifying SLAs.
Textbook1: Chapter1,2

UNIT-2 **(9hrs)**

Cloud Infrastructure: Cloud Computing at Amazon, Cloud Computing: The Google Perspective, Microsoft Windows Azure and Online Services, Open-Source Software Platforms for Private Clouds, Cloud Storage Diversity and Vendor Lock-in, Cloud Computing Interoperability: The Intercloud, Energy Use and Ecological Impact of Large-Scale Data Centers, Service- and Compliance-Level Agreements, Responsibility Sharing Between User and Cloud Service Provider, User Experience, Software Licensing.
Textbook 2: Chapter3: (3.1 to 3.11)

UNIT-3 **(8hrs)**

Understanding Abstraction and Virtualization: Using Virtualization Technologies, Load balancing and Virtualization, Understanding Hypervisors; Capacity Planning: Defining Baseline and Metrics, Baseline measurements, System metrics, Load testing, Resource ceilings, Server and instance types, Network Capacity, Scaling
Textbook1: Chapter5,6

UNIT-4 **(8hrs)**

Understanding Cloud Security: Securing the Cloud, The security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance, Establishing Identity and Presence, Identity protocol standards, Windows Azure identity standards.
Textbook1: Chapter12

UNIT-5 **(7hrs)**

Fog Computing and its Applications: Introduction: Essential characteristics in fog computing, Fog nodes, Fog node deployment model. View of a Fog Computing Architecture: Node view, System view, Software view. Fog Computing in IoT: Importance of Fog Computing, Time sensitiveness in Fog Computing. Selected Applications of Fog Computing.
Textbook3: Chapter11
Edge Computing State-of-the-Art Interfaces and Devices: Middleware, Hydra, Aura, TinyDB, FiWare, Application Interfaces, Edge Computing Simulators: PureEdgeSim, IoTSim-Edge, iFogSim and Edge CloudSim.
Textbook4

Course outcomes:
On successful completion of this course, students will be able to:

1. Create, test and debug Android application by setting up Android development environment.
2. Implement adaptive, responsive user interfaces that work across a wide range of devices.
3. Infer long running tasks and background work in Android applications
4. Demonstrate methods in storing, sharing and retrieving data in Android applications.
   Infer the role of permission and security for Android applications

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Cloud Computing Bible	Barrie Sosinsky	Wiley Publishing Inc.	2011
2	Cloud Computing Theory and Practice	Dan C. Marinescu	Morgan Kaufmann, Elsevier	2013
3	Introduction to IOT	SudipMisra, Anandarup Mukherjee, Arijit Roy	Cambridge University press	2020
Reference Books				
1	Cloud Computing Principles and Paradigms	RajkumarBuyya, James Broberg,AndrzejGoscinski	Wiley Publishing Inc.	2013
2	Cloud Computing and SOA Convergence in Your Enterprise:	David S. Linthicum	Addison-Wesley Professional	1st Edition
3	Distributed and Cloud Computing	Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra	Morgan Kaufman Publishers	2012

Mapping of Course outcomes (COs) to Program outcomes (Pos):

Program Articulation Matrix															
Course Outcomes	**Program Outcomes**												**Program Specific Outcome**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2											2	
CO2			2											2	
CO3			2											2	
CO4			2											2	
over all			2											2	

Degree of compliance 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

CRYPTOGRAPHY & NETWORK SECURITY

Course Code	S6CSPE03	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. **Understand** the basic concept of Cryptography and Network Security along with their mathematical models, quantum security.
2. **Explain** security issues, services, goals and mechanisms.
3. To **illustrate** how to encrypt and decrypt messages using block ciphers and stream ciphers
4. **Analyse** public key cryptosystems, authentication protocols and quantum cryptography algorithms.
5. **Develop** code to implement cryptographic and quantum cryptographic algorithms

UNIT-1 **(07 hrs)**

COMPUTER AND NETWORK SECURITY CONCEPTS: Computer Security concepts, The OSI Security Architecture, Security Attacks, Services and Mechanisms, A Model of Network Security.

INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality.

SYMMETRIC CIPHERS: Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT-2 **(08 hrs)**

BLOCK CIPHER OPERATION: Multiple Encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output feedback Mode, Counter Mode.

BLOCK CIPHER AND THE DATA ENCRYPTION STANDARD: Traditional Block Cipher Structures, The Data Encryption Standard, DES Example, Strength of DES, Block Cipher Design principles.

ADVANCED ENCRYPTION STANDARDS:Finite field Arithmetic, AES Structure, AES Transformation Functions, AES key Expansion, An AES Example**.**

UNIT-3 **(08 hrs)**

RANDOM BIT GENERATION AND STREAM CIPHERS: Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, Pseudorandom Number Generation using a block cipher, Stream Cipher,RC4.

ASYMMETRIC CIPHERS: Public Key Cryptography and RSA:Principles of Public-Key Cryptosystems, The RSA Algorithm, Other Public Key Cryptosystems :Diffie-Hellman Key Exchange.

CRYPTOGRAPHIC DATAINTEGRITY ALGORITHMS: Cryptographic Hash Functions: Applications of Cryptographic hash functions, Two simple hash Functions, Secure Hash

UNIT-4 **(08 hrs)**

MESSAGE AUTHENTICATION CODES: Authentication Requirements, Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs based on Hash Functions:HMAC.

DIGITAL SIGNATURES: Digital Signatures, NIST Digital Signature Algorithm.

TRANSPORT-LEVEL SECURITY: Web Security considerations, Transport Layer Security, HTTPS, Secure Shell(SSH).
IP SECURITY: Overview, IP Security Policy

UNIT-5 **(08 hrs)**

ELECTRONIC MAIL SECURITY: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy.
QUANTUM COMPUTING BASIC CONCEPTS: The Postulates of Quantum Mechanics , Quantum Bits, Representations of Qubits, Superpositions, Quantum error correction.
QUANTUM CRYPTOGRAPHY and ALGORITHMS: Shor's Factoring Algorithm - Quantum Key Distribution - BB84 Protocol

Course outcomes:
On successful completion of this course, students will be able to:

1. **Apply** the knowledge of mathematics to perceive the foundations of Cryptography and network security, quantum cryptography and explain the security principles.
2. **Design** solutions for problems on classical encryption techniques and illustrate symmetric and asymmetric cryptographic algorithms.
3. **Develop** solutions for problems on public key cryptosystems.
4. **Analyse** different authentication protocols, integrity protocols and quantum cryptography protocols
5. **Apply** the knowledge of engineering fundamentals to comprehend existing network security protocols.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Cryptography and Network Security	William Stallings.	Prentice Hall of India	Seventh Edition,2017
	(Chapters 1.1-1.5, 1.8, 2.4-2.6, 3.1-3.5, 4.1-4.5, 6.1-6.6, 7.1-7.6, 8.1-8.5, 9.1-9.2, 10.1,11.1-11.2,11.5,12.1-12.5,13.1,13.4,14.1-14.4,15.3,17.1-17.4,19.1,19.5,20.1-20.2).			
2	Quantum Computing, A Beginners Introduction	Parag K Lala	Mc Graw Hill Education	First edition (1 November 2020).
Reference Books				
1	Network Security:Private Communication in a Public World	Charlie Kaufman, Radia Perlman, Mike Speciner,	Pearson Education Asia	Second Edition 2002
2	Cryptography and Network Security	AtulKahate	Tata Mc GrawHill	2003
3	Quantum Computation and Quantum Information	Michael A. Nielsen, Issac L. Chuang	Cambridge University Press	2010
4	Quantum Computing for Everyone	Chris Bernhardt	The MIT Press	Reprint edition (8 September 2020)

Course : Cryptography & Network Security

COURSE ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2														2
CO2		2	3												2
CO3		2	3												2
CO4		2													2
CO5	3	2													2
Overall CO	3	2	3												2
PROGRAM ARTICULATION MATRIX															
Course Outcomes	**PROGRAMME OUTCOMES**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
Overall CO	3	2	3												2

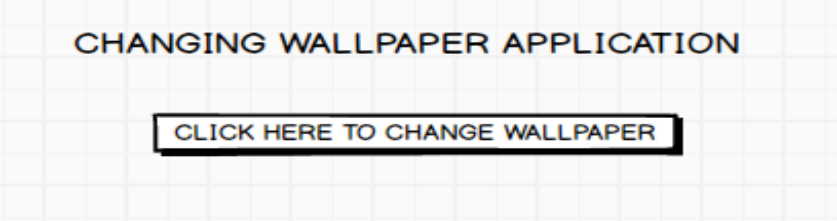
B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

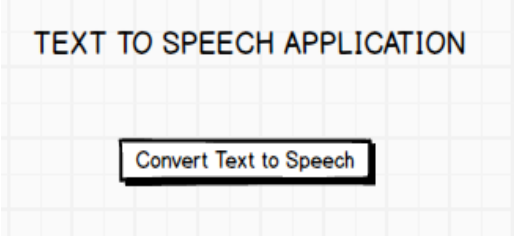
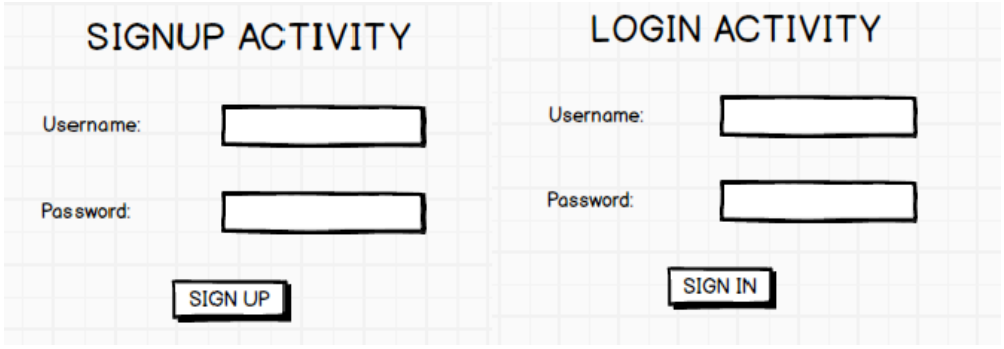
MOBILE APPLICATION DEVELOPMENT LABORATORY

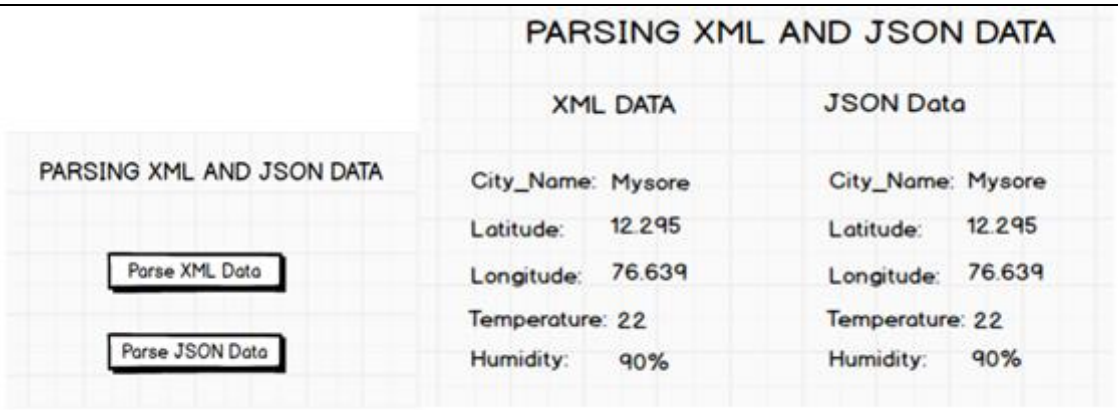
Course Code	N6ADL01	CIE Marks	50
TeachingHours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	1	Exam Hours	3
Lecture Hours	-	Practical Hour	26 hrs

Course objectives: The course will enable students to

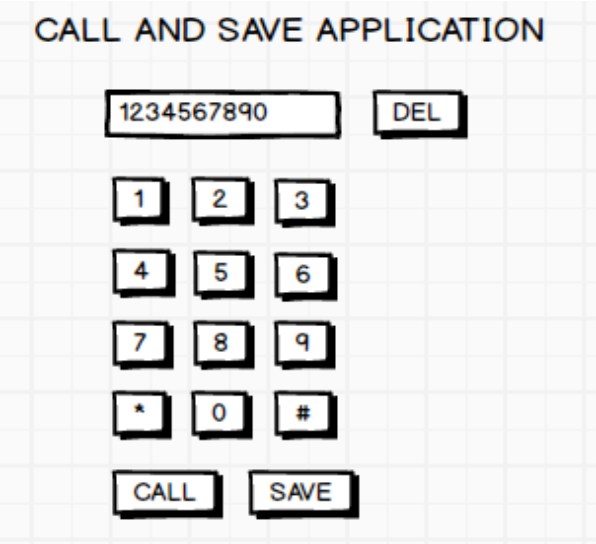
1. Learn to setup Android application development environment and AI technologies.
2. Develop native mobile apps to extend databases and use them with respect to AI context.
3. Learn to develop user interfaces for interacting with apps and triggering actions.
4. Interpret tasks used in handling multiple activities.
5. Identify options to save persistent application data.

Sl. no.	Experiments
1	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. 
2	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a Text View control. 

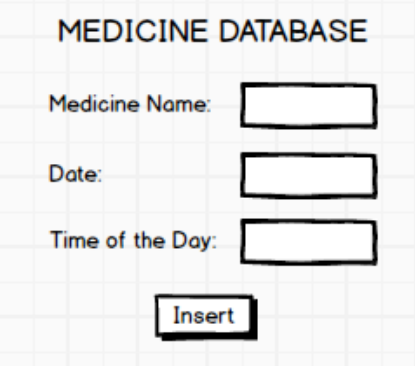
3	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice. 
4	Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: • Password should contain uppercase and lower case letters. • Password should contain letters and numbers. • Password should contain special characters. • Minimum length of the password (the default valueis8). On successful **SIGN UP** proceed to the next Login activity. Here the user should **SIGN IN** using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another. 
5	Develop applications that supports asynchronous task to send notification via SMS.
6	Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.



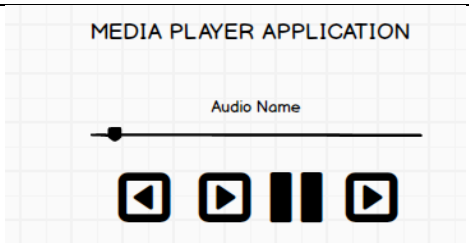
7 Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.



8 Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the MedicineName.



9 Create an application to demonstrate a basic media player that allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required.

	
10	Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is **$E = P * (r(1+r)^n)/((1+r)^n-1)$,**where E = The EMI payable on the car loan amount P = The Car loan Principal Amount r = The interest rate value computed on a monthly basis n = The loan tenure in the form of months The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service

Note: Develop the Android application for AI based problem statements as an open ended project.

Course outcomes:

On successful completion of this course, students will be able to:

1. **Implement** user interfaces for interacting with apps and triggering actions
2. **Synthesize** tasks used in handling multiple activities, Computations and Processing
3. **Articulate** options to save AI application data.
4. **Develop** Android applications related to mobile related server-less database like SQLITE.
5. **Apply** Google Map interface, MP3 audio interface, Text to Speech interface to develop interactive AI context applications.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 20% Marks is to be deducted.

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

Program Articulation Matrix															
Course Outcomes	**Program Outcomes**												**Program Specific Outcome**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2											2	
CO2			2											2	
CO3			2											2	
CO4			2											2	
over all			2											2	

Degree of compliance 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)