

Academic Program: UG

Academic Year 2024-25 Syllabus

V & VI Semester B.E.

Information Science and Engineering



**SHRI DHARMASTHALA MANJUNATHESHWARA
COLLEGE OF ENGINEERING & TECHNOLOGY,**

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU,

Ph: 0836-2447465

Web:

**SDM College of Engineering & Technology,
Dharwad**

It is certified that the scheme and syllabus for **V & VI** semester of UG program in **Information Science & Engineering** is recommended by Board of Studies of **Information Science & Engineering** Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2024-25 till further revision.

Principal

Chairman BoS & HoD

SDM College of Engineering & Technology, Dharwad
Department of **Information Science & Engineering**
(Our motto: *Innovation through Information Technology*)

College Vision and Mission

Vision:

To develop competent professionals with human values.

Mission:

1. To have contextually relevant Curricula.
2. To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
3. To enhance Research Culture.
4. To involve Industrial Expertise for connecting classroom content to real life situations.
5. To inculcate Ethics and impart soft-skills leading to overall Personality Development.

SDMCET- Quality Policy

- In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stakeholders.

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work
- Trust

Department Vision and Mission

Vision:

- To develop competent Engineers with Knowledge and skills in contemporary Information Technology practices.

Mission:

- To develop contemporary curriculum in information technology delivered using Innovative teaching learning practices and ICT tools.
- To promote research and expose students and faculty to best Practices in Information Technology.
- To inculcate the best moral values and professional ethics in students.

Programme Educational Objectives (PEOs):

- Develop into Information Technology Professionals with expertise in providing solutions to Information Engineering problems.
- Pursue higher studies with the sound knowledge of basic concepts and skills in basic science, humanities and Information Technology disciplines.
- Exhibit professionalism, ethics and ability to work in teams.

Program Outcomes (POs):

Sl. No.	(A) Description of Program Outcomes
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Engineering Graduates will demonstrate:

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

(B) Description of Program Specific Outcomes (PSOs)

- 13 An ability to develop logical reasoning, coding skills, analysis and mathematical modeling.
- 14 An ability to modify, debug, test and adapt software modules for varied applications.

SDMCET : Syllabus

Information Science and Engineering												
Scheme for V Semester : Academic Year – 2024-25												
Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination			Credits	
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	HSMS	22UISC500	Project Management and Economics	IS	3	0	0	03	50	100	100	3
2	PCC	22UISC501	Programming with Java	IS	4	0	0	03	50	100	100	4
3	PCC	22UISC502	Database Management System	IS	4	0	0	03	50	100	100	4
4	PEC	22UISE5XX	Program Elective Course -I	IS	4	0	0	03	50	100	100	4
5	PCCL	22UISL503	Database Management System Laboratory	IS	0	0	2	03	50	50	100	1
6	PCCL	22UISL504	Java Laboratory	IS	0	0	2	03	50	50	100	1
7	PROJ	22UISL505	Minor Project-I	IS	0	0	4	03	50	50	100	2
8	MC	22URMK506	Research Methodology & IPR	IS	2	0	0	02	50	50	100	2
9	MC	22UESK507	Environmental studies	IS	1	0	0	01	50	50	100	1
10	HSMS	22USSK508	Soft Skills-I	CIII	0	0	2	-	50	-	50	Audit
11	MC	22UNSK509	National Service Scheme (NSS)	NSS	0	0	2	-	50	-	50	Audit
Total											1000	22
Program Elective Course –I												
11	PEC-I	22UISE521	Advanced Data Structures	IS	4	0	0	03	50	100	100	4
12	PEC-I	22UISE522	Human Computer Interface	IS	4	0	0	03	50	100	100	4
<p>HSMS: Humanity and management Science course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, AEC: Ability Enhancement course, MC: Mandatory Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. PEC: Program elective course, PROJ: Project. TD: Teaching department, PSB: Paper setting Board.</p> <p>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 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.</p> <p>Minor-Project-I: The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select</p>												

SDMCET : Syllabus

a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.

Soft Skills-I: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resource. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

National Service Scheme: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. 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 activities. This course 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.

AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

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Information Science and Engineering												
Scheme for VI Semester : Academic Year – 2024-25												
Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination			Credits	
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	PCC	22UISC600	Machine Learning	IS	4	0	0	03	50	100	100	4
2	PCC	22UISC601	Computer Networks	IS	4	0	0	03	50	100	100	4
3	PCC	22UISC602	Big Data Analytics	IS	3	0	0	03	50	100	100	3
4	PEC	22UISE6XX	Program Elective Course-II	IS	3	0	0	03	50	100	100	3
5	PEC	22UISE6XX	Program Elective Course-III	IS	3	0	0	03	50	100	100	3
6	OEC	22UIISO6XX	Open Elective Course-I	IS	3	0	0	03	50	100	100	3
7	PCCL	22UISL603	Web Technology Laboratory	IS	0	0	2	03	50	50	100	1
8	PCCL	22UISL604	Computer Networks Laboratory	IS	0	0	2	03	50	50	100	1
9	PROJ	22UISL605	Minor Project-II	IS	0	0	4	03	50	50	100	2
10	HSMS	22USSK606	Soft Skills-II	CIII	0	0	2	-	50	-	50	Audit
11	MC	22UNSK607	National Service Scheme (NSS)	NSS	0	0	2	-	50	-	50	Audit
Total											1000	24
Program Elective Course - II												
1	PEC-II	22UISE621	Object Oriented Modeling & Design Patterns	IS	3	0	0	03	50	100	100	3
2	PEC-II	22UISE622	Advanced Database Management System	IS	3	0	0	03	50	100	100	3
Program Elective Course – III												
1	PEC-III	22UISE631	Storage Management	IS	3	0	0	03	50	100	100	3
2	PEC-III	22UISE632	Devops	IS	3	0	0	03	50	100	100	3
Open Elective Course-I												
1	OEC-I	22UIISO641	Agile Methodologies	IS	3	0	0	03	50	100	100	3
2	OEC-I	22UIISO642	Fintech	IS	3	0	0	03	50	100	100	3

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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 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 numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are entitled to opt for the open electives offered by their parent Department and other departments provided that 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 are as prescribed by the DAP.

Minor-project-II: It is either a continuation of Minor-Project-I or a new project. The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.

Soft Skills-II: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resource. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

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V Semester

22UISC500	Project Management and Economics	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs):

Students should be able to understand the basic principles and components of project management, Appreciate the integrated approach to managing projects, apply the appropriate project management tools and techniques, Prepare project schedules with reports.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe the concepts of Project Management and relationships among different portfolio.	1, 2	11	12
CO-2	Analyze various sub processes in the project management frameworks.	1	2	12
CO-3	Develop project plans for various types of organizations	10	11	12
CO-4	Evaluate risks in projects and economics analysis of project feasibility.	11	-	12
CO-5	Illustrate the concepts, tools and techniques for managing large projects.	5,10	1	12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.67	2.5	-	-	3.0	-	-	-	-	3.0	2.33	1.0	-	-

Pre-requisites:

1. Knowledge of software Engineering

Contents:**Unit I**

Introduction: Project, Project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge.

08 Hrs.**Unit II**

Generation and Screening of Project Ideas: Generation of ideas, monitoring the environment, corporate appraisal, scouting for project ideas, preliminary screening, project rating index, sources of positive net present value. Project costing.

Project Scope Management: Project scope management, collect requirements define scope, create WBS, validate scope, control scope.

Organizational influences & Project life cycle: Organizational influences on project management, project state holders & governance, project team, project life cycle.

08 Hrs.**Unit III**

Project Integration Management: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.

Project Quality management: Plan quality management, perform quality assurance, control quality.

08 Hrs.**Unit IV**

Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk.

Project Scheduling: Project implementation scheduling, Effective time management, Different scheduling techniques, Resources allocation method, PLM concepts. Project life cycle costing.

08 Hrs.

Unit V

Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management.

07 Hrs.

Reference Books:

- 1) Prasanna Chandra, "Project Planning Analysis Selection Financing Implementation & Review", 10th Edition, Tata McGraw Hill Publication, 2023.
- 2) Harold Kerzner, "Project Management A System approach to Planning Scheduling & Controlling", John Wiley & Sons Inc., 12th Edition, 2017.
- 3) Rory Burke, "Project Management – Planning and Controlling Techniques", John Wiley & Sons, 5th Edition, 2013.

22UISC501	Programming with Java	(4-0-0) 4
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Contact Hours: 52

Course Learning Objectives (CLOs):

Students should be able to write object-oriented code for a given problem applying the Java language features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Implement the concepts of object-oriented programming using Java language.	1, 13,14	2	3,12
CO-2	Illustrate the concept of Interface and Packages.	13, 14	1,2,3	12
CO-3	Apply multi-threaded programming and exception handling in Java programs.	1, 13,14	2	3,12
CO-4	Write programs to solve a given problem using Generics and Collection Frameworks.	1,13,14	2,5	12
CO-5	Use JDBC to write programs	1	2, 13,14	3,12

	that can interact with the database and Apply the extended features in coding.			
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POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.8	2.0	1.25	-	2.0	-	-	-	-	-	-	1.0	2.8	2.8

Pre-requisites:

1. Basic Programming Skill
2. Exposure to Object Oriented Programming Paradigm

Contents:

Unit I

Introduction to Java: Salient features of Java, Object-Oriented Programming Approach, Byte Code, JVM; Basic constructs of the language, Typecasting; Arrays, String and StringBuffer.

Classes: Class Fundamentals, Declaring objects, Object Reference Variables, constructors, this keyword, Garbage collection, finalize() method.

10 Hrs.

Unit II

Inheritance: Inheritance basics, super keyword, Multi-level hierarchy, Method overriding, Dynamic Method Dispatch.

Packages and Interfaces: Packages, Access Protection, Importing packages, Interfaces.

10 Hrs.

Unit III

Exception handling in Java: Exception-handling fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch clauses; throw, throws and finally clauses, Java's built-in exceptions, Creating Own Exception Subclasses.

Multi-threaded Programming: Java Thread Lifecycle, Creation of threads with different approaches: Extending Thread, Implementing Runnable, Thread Priorities, Synchronization

12 Hrs.

Unit IV

Generics: What are generics, a simple generics example, a generic class with two type parameters, general form of a generic class,

10 Hrs.

bounded types, using wildcard arguments, creating a generic method.

Collections Framework: Collections overview, the collection interfaces, the collection classes, accessing a collection via an iterator, for-each alternative to iterators, storing user-defined classes in collections.

Unit V

JDBC: Introduction, JDBC driver types, JDBC Process, Statement Objects, ResultSet, Reading the ResultSet.

Extended features of Java: Running Java Files, Switch Expressions, Sealed Classes, Functional Interfaces, Lambda Expressions, Miscellaneous changes

10 Hrs.

Reference Books:

- 1) Herbert Schildt, "Java The Complete Reference", 12th Edition, Tata McGraw-Hill Education, 2022
- 2) E. Balagurusamy, "Programming with Java - A Primer", 7th Edition, McGraw Hill Education, 2023.
- 3) Jim Keogh, "J2EE The Complete Reference", McGraw Hill Education, 2011.

22UISC502	Database Management System	(4-0-0) 4
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Contact Hours: 52

Course Learning Objectives (CLOs): The main objective of this course is to provide students with the background to design and implement databases, and usedatabase management systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Identify, analyze and define database objects. Design ER models.	-	2	1
CO-2	Implement integrity constraints perform algebraic operation using relational model and write simple SQL queries	13,14	3	2,5
CO-3	Use Structured Query Language	13	-	5,12,14

	(SQL) for database manipulation. Develop applications to interact with databases.			
CO-4	Design and build simple database systems using functional dependency and Normalization techniques.	-	3,13	5,12,14
CO-5	Analyse transaction processing, concurrency control and data recovery techniques.	3	-	12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.0	1.5	2.3	-	1.0	-	-	-	-	-	-	1.0	2.6	1.6

Pre-requisites: -

Contents:

Unit I

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships:

Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.

10 Hrs.

Unit II

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE

statements in SQL, Additional features of SQL

10 Hrs.

Unit III

SQL : Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.

10 Hrs.

Unit IV

Normalization: Database Design Theory : Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

10 Hrs.

Unit V

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures

12 Hrs.

Reference Books:

- 1) Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2017.
- 2) Ramakrishnan, and Gehrke, "Database management systems", 3rd Edition, McGraw Hill, 2014.
- 3) Silberschatz Korth and Sudharshan, "Database System Concepts", 6th Edition, Mc-GrawHill, 2013.
- 4) Coronel, Morris, and Rob, "Database Principles Fundamentals of Design, Implementation and Management", 10th Edition, Cengage Learning 2014.

22UISL503 Database Management System Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): The major objective of this lab is to provide a strong formal foundation in database concepts, technology and practice to the participants, to groom them into well-informed database application developers.

Course Outcomes(COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Design and implement a database schema for a given problem-domain.	3,13,14	1,2	12
CO-2	Analyze the given database and apply the normalization.	13,14	1,2,3	12
CO-3	Demonstrate SQL, DML/DDDL commands.	5,13,14	4	12
CO-4	Design and build a GUI using a GUI building tool.	5,13,14	3	12
CO-5	Develop solutions for real life problems by working in teams.	6,7,13,14	10,11,12	8,9

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.0	2.0	2.33	2.0	3.0	3.0	3.0	1.0	1.0	2.0	2.0	1.2	3.0	3.0

Pre-requisites:

1. Basic Programming Language
2. Logical reasoning

Contents:

PART-A

1. Analyze the given data and implement the following
2. Create the database
3. Design ER models and tables
4. Create constraints/ inserting the records
5. Write queries in SQL using DDL, DML commands
6. Write queries using aggregate functions, group by, having clause/union, intersect, minus
7. Subqueries returning single/multiple rows
8. Co-related subqueries
9. Joins, Views

PART-B

Design and implement a real-world database application in the form of a project

Reference books:

- 1) Elmasri and Navathe: "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2011.
- 2) Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw-Hill, 2011
- 3) Silberschatz, Korth and Sudharshan, "Data Base System Concepts", 5th Edition, McGraw Hill, 2008.
- 4) C.J.Date, A. Kannan, S. Swamynatham, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

22UISL504	Java Laboratory	(0-0-2) 1
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Contact Hours: 26

Course Learning Objectives (CLOs):

Students should be able to write object-oriented code for a given problem applying the Java language features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Implement the concepts of object oriented programming, Multi-threaded programming, Interfaces and Packages using Java language	13,14	1,2,3	8,12
CO-2	Demonstrate the use of JDBC and MySQL database to write Java programs that interact with databases	2,13	1,3,14	5,8,12
CO-3	Use exception handling mechanisms.	13	1,3,14	12,8

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.0	2.5	2.0	-	1.0	-	-	1.0	-	-	-	1.0	3.0	2.3

Pre-requisites: Basic programming skills

Contents:

1. Programs on Classes
2. Programs on Inheritance
3. Programs on Interface and Packages
4. Programs on Exception Handling
5. Programs on Multi-threaded Programming
6. Programs on MySQL and JDBC

Reference Books:

- 1) Herbert Schildt, "Java The Complete Reference", 12th Edition, Tata McGraw-Hill Education, 2022.
- 2) E. Balagurusamy, "Programming with Java - A Primer", 7th Edition, McGraw Hill Education, 2023.
- 3) Jim Keogh, "J2EE The Complete Reference", McGraw Hill Education, 2011.

22UISL505**Minor Project -I****(0-0-4) 2****Contact hours: 52****Course Learning Objectives (CLOs):**

Understand programming language concepts, and object-oriented concepts. Plan, analyze, design and implement a software project. Demonstrate independent learning. Demonstrate the ability to locate and use technical information from multiple sources. Demonstrate an understanding of professional ethics. Participate in a class or project team. Demonstrate the ability to communicate effectively in speech. Demonstrate the ability to communicate effectively in writing. Learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project. Learn about and go through the software development cycle with emphasis on different processes - requirements, design, and implementation phases. Gain confidence at having conceptualized, designed, and implemented a working, medium sized project with their team.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1,12)/PSOs(13, 14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply problem solving and programming skills for identified problem statement.	2, 13	1	14
CO-2	Design the system for an identified requirement	3	4	1

CO-3	Analyze and Incorporate the changes in the development cycle.	4, 2	13	1, 14
CO-4	Demonstrate an ability to work in a team	9	-	11
CO-5	Demonstrate an ability to present the work carried out both in written and oral form.	10	-	11

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.33	3.0	3.0	2.5	3.0	-	-	-	3.0	3.0	-	-	2.5	1.0

Prerequisites:

Any Programming Language

Guidelines for Conduction

Spirit of The Course: To ensure that undergraduates can successfully apply the knowledge they have gained through a project, demonstrates the practical application of principles learnt in different courses and enables students to integrate material learnt at different stages of the curriculum up to the 4th semester; also appreciating the need for domain knowledge for certain applications, and that this may necessitate study within that domain.

1. Students Form a Team. Size of the team can vary from 3. With genuine explanation of bigger or smaller is team is allowed.
2. Guide for this course is a must and will be chosen by team itself by interacting with faculty or the guide can give a problem statement and guide the batch.
3. In consultation with Guide, Team will prepare the project plan and its specific outcomes, which Team promises/declares to accomplish.
4. Project Report: A Course closure document outlining the problems, specifications, including the survey of literature, various results obtained, solutions and the problems faced deviation from the promised milestones, testing report, user manual, appendix reference etc is expected to be produced by each team of project.
5. Demonstration, seminar, Viva-Voce, publications, Reports can be

used for the evaluation.

Assessment:

CIE - Minimum 2 reviews of the project + any other relevant components

Note:

1. There can be designated Committee to monitor this process of Minor Project.
2. An Internal Guide is allotted per group who guides and monitors the project progress.
3. Course Outcomes (2 or more) are to be written per project and should map to following Program Outcomes and Program Specific Outcomes. Internal Guide can include other POs apart from the ones mentioned above if those POs are deemed suitable by them.

22URMK506

Research Methodology & IPR

(2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn about the need and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing. Also expected to learn about the importance of IPR and trade mark.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Formulate the research problem, carryout literature survey and decide the methodology.	-	1	-

CO-2	Use measurement and scaling and carryout data collection.	-	1	-
CO-3	Test the hypothesis, interpret & analyze the results and write the report.	2	3	-
CO-4	Explain the need for IPR and trademark	-	2	-

POs/PSOs	1	2	3	4	5	6
Mapping Level	2	2.2	2	-	-	-

Pre-requisites:

Branch specific course on problem analysis (Preferred)

Contents:

Unit I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology.

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration.

05 Hrs.

Unit II

Reviewing the literature: Importance of the literature review in research, How to review the literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design.

05 Hrs.

Unit III

Data Collection: Collection of primary data, observation method, interview method, collection of data through questionnaires.

Testing of Hypotheses: What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing.

06 Hrs.**Unit IV**

Meaning and conception of IPR, competing, rationale for protection, international conventions, world court.

Copyright: Historical evolution of the law on copy right, meaning, content

Patents: Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions

05 Hrs.**Unit V****Industrial Design:**

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trade marks, application for registration and procedure for registration, procedure and certification of Trademarks

The Information Technology Act: Definitions, certifying authority, meaning of compromise of digital signature, offences and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, World Wide Web and domain names and cyber flying, Self study.

05 Hrs.**Reference Books:**

- 1) C.R. Kothari, Gaurav Garg, Research Methodology: Methods and Techniques, New Age International, 4thEdition, 2018.
- 2) RanjitKumar, Research Methodology a step-by-step guide for beginners, SAGE Publications, 3rdEdition, 2011.

- 3) Fink A, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009.
- 4) N. K. Acharya, Text book on Intellectual Property Rights, 4th Edition, Asia Law House, Hyderabad.

22UESK507 Environmental Studies (1-0-0) 1

Contact Hours: 13

Course Learning Objective (CLO): The Students are to learn in this course about the need of balanced ecosystem, effects of human activities on environment, optimized use of natural resources including energy extraction and current Environmental issues.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to		Mapping to POs (1-12) /PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Discuss the concept of ecosystem and effects of human activities on environment.	-	7	-
CO-2	Describe the adverse effects on health and society due to erratic exploitation of natural resources.	-	-	6
CO-3	Understand various types of energy, sources of energy.	-	6	-
CO-4	Explain different types of Pollution and concept of Global warming, Ozone layer depletion.	-	7	-
CO-5	Discuss the current developments towards NGO to protect environment.	-	6	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	-	-	-	-	-	1.6	2.0	-	-	-	-	-	-	-	-

Course content:

Unit I

Environment and Effects of Human activities on Environment: Introduction, Ecosystem – Types & Structure of Ecosystem, Impacts of Agriculture & Housing, Mining & Transportation. Environmental Impact Assessment, Sustainable Development.

03 Hrs.

Unit II

Natural Resources: Introduction Water resources – Availability & Quality aspects, Water borne diseases, Fluoride problem in drinking water. Material Cycles - Carbon cycle and Nitrogen cycle.

03 Hrs.

Unit III

Energy in Ecological System: Different types of energy, Conventional sources & Non Conventional sources of energy. Solar energy, Hydro electric energy, Wind energy, Nuclear energy, Biomass & Biogas, Fossil Fuels, Hydrogen as an alternative energy.

03 Hrs.

Unit IV

Environmental Pollution: Water Pollution, Land Pollution, Air Pollution, Global Warming, Ozone layer depletion.

02 Hrs.

Unit V

Current Environmental Issues & Environmental Protection: Environmental Acts & Regulations, Role of Nongovernmental Organizations (NGOs). Introduction to GIS & Remote Sensing, Applications of GIS & Remote Sensing.

02 Hrs.

Reference Books:

- 1) P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006.
- 2) Raj Gopalan, "Environmental Studies" Oxford University press, New Delhi, 3rd Edition, 2016.
- 3) Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, 2010.
- 4) Kaushik and Kaushik, "Perspectives in Environmental Studies", New Age International Private Limited, 2005.
- 5) D. L. Manjunath, "Environmental Studies", Pearson, Noida, 2016.

22USSK508

Soft skills - I

(0-0-2) Audit

Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ (13,14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain the significance of communication in the profession.	-	10	-
CO-2	Use the English language with proficiency	-	10	12
CO-3	Solve Aptitude related problems	-	9	12
CO-4	Demonstrate the competency in the placement activities.	-	9	-

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-

Contents:**Unit I**

Number System, Linear Equations + Assessment Test, HCF and LCM, Ratios & Proportions + Assessment Test, Percentage, Profit & Loss + Assessment Test, Time, Work & Distance + Assessment Test, Simple and compound Interest, Averages and Mixtures + Assessment Test, Permutations, Probability + Assessment Test, Data analysis

14 Hrs.**Unit II**

Cyptarithmic Analytical Puzzles, Classification Puzzles, Mathematical Puzzles, Human Relations, Directional tests, Coding and decoding,

10 Hrs.

Series completion – Verbal and Non-verbal Questions from recent recruitment tests

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UNSK509	National Service Scheme	(0-0-2) Audit
		Contact Hours: 24

Course Learning Objectives:

1. Understand the community in which they work.
2. Identify the needs and problems of the community and involve them in problem-solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO1	Understand the importance of his / her responsibilities towards society.	12	6	8
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	12	6	8
CO3	Evaluate the existing system and to propose practical solutions for the same	12	6	8,

	for sustainable development.			
CO4	Implement government or self-driven projects effectively in the field.	12	6	8

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	-	2	-	1	-	-	-	3

Activity list:

1. Waste management– Public, Private and Govt organization.
2. Setting of the information imparting club for women leading to contribution in social and economic issues.
3. Water conservation techniques – Role of different stakeholders– Implementation.
4. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
5. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
6. Developing Sustainable Water management system for rural areas and implementation approaches.
7. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
8. Spreading public awareness under rural outreach programs. (minimum 2 programs).
9. Social connect and responsibilities.
10. Plantation and adoption of plants. Know your plants.
11. Organize National integration and social harmony events /workshops/ seminars. (Minimum 02 programs).
12. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Students have to take up at least three activities on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.

Note: Activities must be unique (Not repeat) across semesters for each student.

CIE will be evaluated based on their presentation, approach and implementation strategies.

Reference Books:

NSS Course Manual, Published by NSS Cell, VTU Belagavi

ASSESSMENT AND EVALUATION PATTERN		
	Time Schedule	CIE (50)
Presentation: on Selected topic	Before the IA-3	50 Marks

Note: Implementation strategies of the project with report duly signed by the Department NSS Coordinator and HoD

22UISE521

Advanced Data Structures

(4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLOs):

It introduces students to a number of highly efficient algorithms and data structures for fundamental computational problems across a variety of areas. Students are also introduced to techniques such as amortized complexity analysis.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe and illustrate different operations on binary search trees, and disjoint sets and also perform amortized analysis on few data	2,13	-	12,14

	structures.			
CO-2	Demonstrate operations like Union, find minimum, extract minimum and delete on mergeable heaps.	2,13	-	14
CO-3	Describe and illustrate operations like searching, insertion, and deletion, traversing on red-black tree and B tree data structure.	-	2,13	14
CO-4	Describe and demonstrate the working of fundamental graph algorithms and sorting networks.		2,13	12,14
CO-5	Describe, Analyze and illustrate hashing, collision resolution, various string matching algorithms.	2,13		1,12,14

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.0	2.6	-	-	-	-	-	-	-	-	-	1.0	2.6	1.0

Pre-requisites: If any

Prerequisites:

1. Data structures
2. Knowledge of any programming language

Contents:

Unit I

Binary Search Tree: Definition and various operations performed on BST

Disjoint sets: Disjoint Set Operations, Representation of disjoint sets
Analysis of union by rank with path compression.

Amortised analysis: Aggregate analysis, the accounting method, the potential method, dynamic table.

12 Hrs.

Unit II

10 Hrs.

Binomial Heaps: Binomial trees and binomial heaps, operations on binomial heaps

Fibonacci Heaps: Structure of Fibonacci heaps, Mergeable – heap operations, decreasing a key and deleting a node

Unit III

Red Black Trees: Properties, Rotations, Insertion, Deletion, Augmented Data structure, Dynamic order statistics, retrieving an element with a given rank

B-trees, B + trees: Definition, operations and Applications **10 Hrs.**

Unit IV

Graph Algorithms: Maximum Flow: Flow Networks, The Ford-Fulkerson method.

Sorting Networks: Comparison Networks, the zero-one principle, Abitonic sorting network, A merging network, A sorting network. **08 Hrs.**

Unit V

Hash Table Representation: hash functions, collision and collision resolution techniques.

String Matching: The naïve string-matching algorithm, The Rabin–Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm. **12 Hrs.**

Reference Books:

- 1) Cormen T.H et al, “Introduction to Algorithms”, 4th Edition, MIT Press, April 2022.
- 2) J. Kleinberg and E. Tardos, “Algorithm Design”, 2nd Edition, Addison-Wesley, 2006.

22UISE522	Human Computer Interface	(4-0-0) 4
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Contact Hours:52

Course Learning Objectives (CLOs):

The objective of this course is to learn basic principles of Human Computer Interface. On learning this course, they should be able to deploy the knowledge of Human Computer Interface principles, design concepts and related methodologies.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12)/ PSOs (13-14)
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At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe the Characteristics of Graphical User Interface (GUI) and the Principles of Human Computer Interface.	1	-	12
CO-2	Explain the Human Computer Interface Process, standards, Structures of menus and basic business functions.	2,5	3	12,13,14
CO-3	Illustrate the components of web Systems and text boxes.	1	2,5	12,13,14
CO-4	Describe the use of multimedia Systems and its accessibility.	1	2	12
CO-5	Summarize the concepts of Windows layout and Illustrate visualization.	1	5	12

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	3.0	2.3	2.0	-	2.3	-	-	-	-	-	-	1.0	1.0	1.0

Pre-requisites: Knowledge of Software Engineering

Contents:

Unit-I

Introduction: Human–Computer Interface, Characteristics of Graphics Interface, Direct Manipulation Graphical System, Web User Interface, Popularity, Characteristics & Principles.

10 Hrs

Unit-II

Human Computer Interaction: Human Computer Interface Process, Obstacles, Usability, Human Characteristics In Design, Human Interaction Speed, Business Functions, Requirement Analysis, Direct and Indirect Methods.

Basic Business Functions, Design Standards, System Timings, Human Consideration In Screen Design, Structures Of Menus, Functions Of Menus, Contents Of Menu, Formatting, Phrasing The Menu, Selecting

12 Hrs

Menu Choice, NavigatingMenus, GraphicalMenus.

Unit-III

Windows: Introduction, Characteristics, Components, Presentation Styles, Types, Managements, Organizations, Operations, Web Systems, Device, Based Controls Characteristics, Screen, Based Controls, Operate Control, Text Boxes, Selection Control, Combination Control, CustomControl, PresentationControl.

10 Hrs

Unit-IV

HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction.

10 Hrs

Unit-V

Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience Design Focus: Applications of augmented reality Information and data visualization Design Focus: Getting the size right.

10 Hrs

Reference Books:

- 1) Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface", 5th Edition, Pearson Education,2010.
- 2) Jenifer Tidwell, "Designing Interfaces Patterns for effective design", 2nd Edition, O'Reilly Media, 2010.
- 3) Jesse James Garrett, "The Elements of User Experience:

User-Centered Design for the Web and Beyond”, 2nd Edition, Pearson Education, 2011.

- 4) Wilbert O. Galitz, “The Essential Guide to Human Computer Interface –An Introduction to GUI Design Principles and Techniques”, 2nd Edition, Wiley Dream Tech,2011.

VI Semester

22UISC600	Machine Learning	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs):

This course introduces principles, algorithms, and applications of machine learning from the point of view of modeling and prediction. It includes formulation of learning problems and concepts of representation, over-fitting, and generalization.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Differentiate between machine learning algorithms based on learning criteria, illustrate data preprocessing techniques and Analyse various performance Metrics.	-	1, 2, 5	10,12,13
CO-2	Discuss and Apply supervised learning methods for Classification and Regression.	2	1,5,13	10,14
CO-3	Apply appropriate clustering techniques for a given scenario.	2	1,5,13	10,14
CO-4	Describe and illustrate the significance of dimensionality reduction techniques for supervised and unsupervised problem solving.	2	1,5,13	10,12,14
CO-5	Illustrate the techniques of Artificial Neural Network, Predictive Analytics and Discuss application of Machine learning.	-	1,2,5,13	10,3, 14

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.0	2.6	1.0	-	2.0	-	-	-	-	1.0	-	1.0	1.8	1.0

Pre-requisites: Knowledge of python, Linear Algebra

Contents:

Unit I

Introduction to Machine Learning: Learning Paradigms

Getting to Know Your Data: Data Objects and Attribute Types

Measuring Data Similarity and Dissimilarity: Data Matrix versus Dissimilarity Matrix, Proximity Measures different Attributes, Dissimilarity of Numeric Data.

Data preprocessing – Building a proper data set for different machine learning tasks.

Evaluation Metrics: ROC Curves, Confusion Metrics, Precision, Recall, F1 score

08 Hrs.

Unit II

Supervised Learning Technique in Machine Learning: Linear and Multilinear Regression, concept learning-Find-S algorithm Classification-, Decision tree, Naïve Bayes Classifier.

07Hrs.

Unit III

Unsupervised Learning in Machine Learning- Clustering basics, Partitioned (K-Means clustering, K-Mode clustering), Hierarchical (Agglomerative versus Divisive Hierarchical Clustering), and Density-based (DBSCAN: Density-Based Clustering Based on Connected Regions with High Density), Expectation maximization.

08 Hrs.

Unit IV

Recommender system: Introduction, Content-Based and Collaborative Filtering, Dimensionality Reduction, Matrix Factorization, Evaluating Recommender System.

08 Hrs.

Unit V

Artificial Neural Network: Biological Neuron, Artificial Neural Model-Types of activation functions, Linear and Non-Linear Separable Problem, Back propagation algorithm.

Predictive Analytics- Ensemble Techniques, Bagging and Boosting

Applications of Machine learning-Real time applications (ex: Healthcare, Retail, Financial Services, Manufacturing & Hospitality).

09 Hrs.

Reference Books:

- 1) Tom M Mitchell, "Machine Learning", 1st Edition, McGraw Hill Education, 2017.
- 2) Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition 2014.
- 3) Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", 2nd Edition, MIT Press, 2018.
- 4) Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer series in statistics, 2017.

22UISC601	Computer Networks	(4-0-0) 4
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Contact Hours: 52

Course Learning Objectives (CLOs): The course introduces main concepts of networking; application areas; classification; reference models; transmission environment; technologies; routing algorithms; IP, UDP and TCP protocols; reliable data transferring methods; application protocols.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain basic concepts of OSI and TCP/IP reference model, services and role of each layer, networks devices and transmission media, Analog and digital data transmission.	1		12
CO-2	Apply channel allocation, framing, error and flow control techniques.	2,13	1	-
CO-3	Analyze the functionalities of Network Layer in real life scenarios.	1,13	2	-
CO-4	Explain the different Transport	1,2	4	12

	Layer functions.			
CO-5	Explain the different protocols used at application layer.	1,2		12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO13	PSO14
Mapping Level	2.8	3.0	-	2.0	-	-	-	-	-	-	-	1.0	3.0	-

Contents:

Unit I

INTRODUCTION: Network applications, network hardware, network software, reference models: OSI,TCP/IP, Internet, Connection oriented network - X.25, frame relay.

THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

10 Hrs.

Unit II

THE DATA LINK LAYER: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet.

THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

12 Hrs.

Unit III

THE NETWORK LAYER: Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, Network layer in the internet (IPv4 and IPv6), Quality of Service

10 Hrs.

Unit IV

THE TRANSPORT LAYER: Transport service, elements of transport protocol, Simple TransportProtocol, Internet transport layer protocols: UDP and TCP.

10 Hrs.

Unit V

THE APPLICATION LAYER: Domain name system, electronic mail, World Wide Web: architecturaloverview, dynamic web document and http.

APPLICATION LAYER PROTOCOLS: Simple NetworkManagement Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

10 Hrs.

Reference Books:

- 1) Andrew S. Tanenbaum, David J. Wetherall, University of Washington, "Computer Networks", Pearson Publication, 5th Edition, 2011.
- 2) Behrouz A. Forouzan, Data communication and Networking, 4th Edition, McGraw-Hill Publication, 2006
- 3) Kurose, Ross, "Computer Networking: A top down approach", Pearson Education, India, 2010

22UISC602	Big Data Analytics	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs): Students should understand big data for business intelligence, to learn business case studies for big data analytics. To Manage big data without SQL, to understand map-reduce analytics using Hadoop and related tools to explore more on Hadoop related tools.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12) / PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Illustrate big data and use cases from selected business domains	-	1,2	3
CO-2	Illustrate NoSQL big management	-	1,5	2,12
CO-3	Interpret, configure Hadoop and HDFS	-	2,5	
CO-4	Demonstrate map-reduce analytics using Hadoop	1,2	5,13,14	4,12
CO-5	Apply Hadoop related tools such as HBase, Cassandra, Pig, Hive and Spark for big data Analytics.	1,2	5,13,14	4,12

POs/PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.5	2.5	1.0	-	2.0	-	-	-	-	-	-	1.0	2.0	2.0

Prerequisites:

- 1) Knowledge of data structure, data bases and basic statistics,
- 2) Some programming experiences.

Contents:

Unit-I

Introduction to Big Data: What is Analytics? What is Big Data? Characteristics of Big Data, Domain Specific Examples of Big Data, Analytics Flow for Big Data, Big Data Stack, Mapping analytics Flow to Big Data Stack, Case Study: Genome Data Analysis, Case Study: Weather Data Analysis, Analytics Patterns.

Setting up Big Data Stack: Horton works Data Platform (HDP), Cloud era CDH Stack, Amazon Elastic MapReduce (EMR), Azure HD Insight. **08 Hrs**

Unit-II

Big Data Patterns: Analytics Architecture Components & Design Styles, MapReduce Patterns.

NoSQL: Key-Value Databases, Column Family Data bases, Graph Databases, Neo4j. **07 Hrs**

Unit-III

Data Acquisition: Data Acquisition Considerations, Publish -Subscribe Messaging Frameworks, Big Data Collection Systems, Messaging Queues, Custom Connectors.

Big Data Storage: HDFS, HDFS Architecture, HDFS Usage Examples. **08 Hrs**

Unit-IV

Batch Analysis: Hadoop and MapReduce, Hadoop – Map Reduce Examples, Pig, Case Study: Batch Analysis of News Articles, ApacheOozie, Apache Spark, Search.

Real-time Analysis: Stream Processing, Storm Case Studies, In-Memory Processing, Spark Case Studies. **08 Hrs**

Unit-V

Interactive Querying: Spark SQL, Hive, Amazon Redshift, Google BigQuery.

Serving Databases & Web Frameworks: Relational (SQL) Databases, Non-Relational (NoSQL) Databases, Python Web Application Framework - Django, Case Study: Django application for viewing weather data, Analytics Algorithms, Data Visualization.

08 Hrs**Reference Books:**

- 1) Vijay Madiseti, Arshdeep Bahga, "Big Data Science & Analytics: A Hands-On Approach", Published by VPT (2016).
- 2) Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilley, 2012.
- 3) E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", 1st Edition, O'Reilley, 2012.
- 4) Lars George, "HBase: The Definitive Guide", 1st Edition, O'Reilley, 2011.
- 5) Alan Gates, "Programming Pig", 1st Edition, O'Reilley, 2011.

22UISL602	Web Technology Laboratory	(0-0-2) 1
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Contact Hours: 26

Course Learning Objectives (CLOs): Students should understand the Structure of WWW, should be able to develop and deploy simple web applications using HTML5 tags, Java Scripts, PHP, MySQL and Servlets.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply CSS to style the web pages	-	2,3,13,14	8,12,
CO-2	Create XML documents and XML Schema	-	1,13,14	8,12
CO-3	Develop web applications using PHP which can interact with MySQL database	13,14	2,3,5	8,12
CO-4	Create servlets using Java language	1,13,14	2,3,5	8,12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.5	2.0	2.0	-	2.0	-	-	1.0	-	-	-	1.0	2.5	2.5

Pre-requisites: Java programming

Contents:

1. Web page validation
2. Programs on JavaScripts
3. Programs on XML, XSD and XSLT
4. Programs on PHP and MySQL
5. Programs on Servlets

ReferenceBooks:

- 1) Robert W. Sebesta, “Programming the World Wide Web”, 8th Edition, Pearson Education, 2020.
- 2) Herbert Schildt, “Java The Complete Reference”, 12th Edition, Tata McGraw-Hill Education, 2022.

22UISL603	Computer Networks Laboratory	(0-0-2)1
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Contact Hours: 26

Course Learning Objectives (CLOs): To understand the functionalities of various layers of OSI model in networks. Students will be able to pursue their study in advanced networking courses.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Demonstrate and Implement the working of different concepts of networking using sockets in C or C++.	5,13	1, 2	12, 14
CO-2	Implement and analyze networking protocols using modern tools.	5	1, 2	-

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO13	PSO14
Mapping Level	2.0	2.0	-	-	3.0	-	-	-	-	-	-	1.0	3.0	1.0

Contents:

Prerequisites:

1. Computer networks

PART-A (USING Cisco Packet Tracer/NS2/NS3 Simulator)

- Simulation of different network topologies and routing algorithms.

PART-B (Using Sockets)

- Write a C/C++/Java Program to demonstrate different networking concepts and routing algorithms using Sockets

Reference Books:

- 1) Andrew S. Tanenbaum, David J. Wetherall, University of Washington, "Computer Networks", Pearson, 5th Edition, 2011.
- 2) Behrouz A. Forouzan, Data communication and Networking, 4th Edition, 2006, McGraw-Hill, India.
- 3) Kurose, Ross, "Computer Networking: A top down approach", Pearson Education, 2010 India

22UISL604	Minor Project - II	(0-0-4) 2
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Contact Hours: 52

Course Learning Objectives (CLOs): Though the Specific objectives of this course depends on the Project chosen, below are the generic objectives of this course:

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply problem solving and programming skills for identified problem statement.	2, 13	1	14
CO-2	Design the system for an identified requirement	3	4	1
CO-3	Analyze and Incorporate the changes in the development cycle.	4, 2	13	1, 14

CO-4	Use modern tools for realizing the solution.	5		14
CO-5	Demonstrate an ability to present the work carried out both in written and oral form in a team	10		11

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.33	3.0	3.0	2.5	3.0	-	-	-	3.0	1.0	-	-	2.5	1.0

Prerequisites: Knowledge of:

- a) Software Engineering concepts
- b) Any Programming Language

Guidelines for Conduction

Spirit of The Course: To ensure that undergraduates can successfully apply the knowledge they have gained through a project, demonstrates the practical application of principles learnt in different courses and enables students to integrate material learnt at different stages of the curriculum up to the 5th semester; also appreciating the need for domain knowledge for certain applications, and that this may necessitate study within that domain.

1. Students Form a Team. Size of the team can vary from 2 to 3. With genuine explanation bigger or smaller is team is allowed.
2. Students can choose industry mentors to mentor their project or department will allocate industry mentors according to their expertise.
3. Guide for this course is a must and will be chosen by team itself by interacting with faculty or Faculty can give a problem statement and guide the batch.
4. In consultation with Guide, Team will prepare the project plan and its specific outcomes, which Team promises/declares to accomplish.
5. Synopsis should be prepared in consultation with the respective guides and industry mentors.
6. Project Report: A Course closure document outlining the problems,

specifications, including the survey of literature, various results obtained, solutions and the problems faced deviation from the promised milestones, testing report, user manual, appendix reference etc is expected to be produced by each team of project.

7. Demonstration, Viva-Voce, publications, Reports can be used for the evaluation.
8. There can be designated Committee to monitor this process of MiniProject.

Assessment:

CIE - Minimum 3 reviews of the project + any other relevant components. CIE is assessed for 50 marks. Out of 50 marks; Guide will assess for 25 marks (based on reviews) and the coordinator will assess for 25 marks (based on synopsis and report)

SEE – SEE exam and Project Demonstration + any other component as decided by Project Coordinator and HoD

Note:

- There can be designated Committee to monitor this process of MiniProject.
- An Internal Guide is allotted per group who guides and monitors the project progress.
- Course Outcomes (2 or more) are to be written per project and should map to following Program Outcomes and Program Specific Outcomes. Internal Guide can include other POs apart from the ones mentioned below if those POs are deemed suitable by them.
- Industry, society, etc., Interactions are required as part of Project.
- At the end of the course, students are required to submit a minor-project report.

22USSK605	Soft Skills –II	(0-0-2) Audit
		Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Demonstrate the skill in sentence completion and faster reading of passages	-	10	-
CO-2	Use the English language with proficiency	-	10	12
CO-3	Demonstrate the capability of interview facing ability	-	9	12
CO-4	Demonstrate the competency in the placement activities.	-	9	-

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-

Contents:**Unit I**

Vocabulary ▪ Formatting and feeding correct structures ▪ Synonyms and Antonyms ▪ Analogies ▪ Sentence Completion ▪ Error Detection and Correction ▪ Faster reading of Passages ▪ Essays ▪ Carryover plan - Dictionary Usage

10 Hrs.**Unit II**

Understanding Discussions ▪ Parameters measured in GDs ▪ Video Analysis of GDs ▪ Knowledge base and Ideas ▪ Taking the initiative ▪ Introduction and Conclusion

04 Hrs.**Unit III**

Most common personal interview questions ▪ What companies expect ▪ Showing Commitment and Learning Ability ▪ Handling difficult questions ▪ Understanding interviewer psychology ▪ Situation Reaction and Presence of Mind ▪ Dressing right ▪ Interview etiquette

10 Hrs.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UNSK607**National Service Scheme****(0-0-2) Audit****Contact Hours: 24****Course Learning Objectives:**

1. Understand the community in which they work.
2. Identify the needs and problems of the community and involve them in problem-solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO1	Understand the importance of his / her responsibilities towards society.	12	6	8
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	12	6	8
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	12	6	8,
CO4	Implement government or self-driven projects effectively in the field.	12	6	8

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	-	2	-	1	-	-	-	3

Activity list:

1. Waste management– Public, Private and Govt organization.
2. Setting of the information imparting club for women leading to contribution in social and economic issues.
3. Water conservation techniques – Role of different stakeholders– Implementation.
4. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
5. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
6. Developing Sustainable Water management system for rural areas and implementation approaches.
7. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
8. Spreading public awareness under rural outreach programs. (minimum 2 programs).
9. Social connect and responsibilities.
10. Plantation and adoption of plants. Know your plants.
11. Organize National integration and social harmony events /workshops/ seminars. (Minimum 02 programs).
12. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Students have to take up at least three activities on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.

Note: Activities must be unique (Not repeat) across semesters for each student.

CIE will be evaluated based on their presentation, approach and implementation strategies.

Reference Books:

NSS Course Manual, Published by NSS Cell, VTU Belagavi

ASSESSMENT AND EVALUATION PATTERN		
	Time Schedule	CIE (50)
Presentation: on Selected topic	Before the IA-3	50 Marks

Note: Implementation strategies of the project with report duly signed by the Department NSS Coordinator and HoD

22UISE621 Object Oriented Modeling and Design Patterns (3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course makes students to know the process of object oriented system modeling, design patterns and tools used in the industry to enable them to construct software system using various standards and techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply the fundamental object orientation concept in solving problem by indentifying classes, objects, their properties association	1,2	3	12,13
CO-2	Analyze the problem scenario and model the system using UML diagrams	1,2	3,5	12,13,14
CO-3	Illustrate the concepts of interaction models and Design patterns, and its importance insolving object oriented design problems.	1	2,3	12,13

CO-4	Describe the design pattern catalogs. Apply structural patterns to solve design problems.	1,2	3	12
CO-5	Construct design solutions by using behavioral patterns.	1,2	-	12

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	3.0	2.8	2.0	-	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-requisites:

1. Exposure to basics of object oriented Programming Terminologies
2. SoftwareEngineering

Contents:

Unit I

Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence fousefulness of OO development; OO modeling history. Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance.

08 Hrs.

Unit II

Advanced Class Modeling, State Modeling, Advanced State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips, Nested state diagrams; Nested states; Signal generalization; Concurrency

08 Hrs.

Unit III

Interaction Modeling:. Interaction Modeling: Use case models; Sequence models;Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models what is a design pattern? Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. A Notation for Describing Object-Oriented Systems

08 Hrs.

Unit IV

Design Pattern Catalog: Abstract Factory Builder Factory Method Prototype Singleton Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

08 Hrs.

Unit V

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method. A Case Study: Designing a Document Editor.

07 Hrs.

Reference Books:

- 1) Michael Blaha, James Rumbaugh, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education, 2005.
- 2) Ali Bahrami, "Object oriented systems development", McGrawHill, 1999.
- 3) Booch, G., Rumbaugh and Jacobson, "The Unified Modeling Language User Guide", 2nd Edition, Pearson, 2005
- 4) Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, Design Patterns, Pearson Publication, 2013.

22UISE622	Advanced Database Management System	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs): Define parallel and distributed databases and its applications. Show applications of Object Oriented database. Explain basic concepts, principles of intelligent databases. Utilize the advanced topics of data warehousing and mining. Infer emerging and advanced data models.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe Relational Database Concepts and the real world data using object oriented database.	1	2	-

CO-2	Describe and Analyse the secondary storage and file structure	1,2	-	12
CO-3	Illustrate the different data mining and data warehouse applications.	1,2	-	12
CO-4	Illustrate enhanced data models for some advanced applications.	1	3	2
CO-5	Write PL/SQL codes to solve different database problems.	1,2,13,14	3,5,6	7,8,10,12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	3.0	2.4	2.0	-	1.5	2.0	1.0	1.0	-	-	-	1.0	3.0	3.0

Pre-requisites:

1. Database Management System
2. SQL

Contents:

Unit I

Parallel Database Distributed Database and ORDBMS: Architecture for Parallel Databases, Types of Distributed Databases, Distributed DBMS Architecture, Storing Data in a Distributed DBMS. **ORDBMS:** Structured Data Types, Operations on Structured Data, Objects, OIDs and Reference Types, Object oriented versus Object relational database.

07 Hrs.

Unit II

Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures: Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures. **Distributed Database Concepts:** Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed database

08 Hrs.

Unit III

Overview of Data Warehousing and OLAP: Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Difficulties of Implementing Data Warehouses.

07 Hrs.**Unit IV**

Enhanced Data Models for Some Advanced Applications: Active Database Concepts and Triggers, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Introduction to Deductive Databases.

Introduction to Information Retrieval and Web Search: Information Retrieval (IR) Concepts, Retrieval Models, Types of Queries in IR Systems, Text Preprocessing, Inverted Indexing, Evaluation Measures of Search Relevance, Web Search and Analysis. Trends in Information Retrieval.

08 Hrs.**Unit V**

PL/SQL: Basics, Cursors, Exceptions, Subprograms, Packages.

09 Hrs.**Reference Books:**

- 1) Elmasri and Navathe: Fundamentals of Database Systems, 1st Edition, Pearson Education, 2017.
- 2) Raghuram Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.
- 3) Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill, 2010.

22UISE631**Storage Management****(3-0-0) 3****Contact Hours: 39**

Course Learning Objectives (CLOs): The main objective of this course is to provide an understanding of storage architectures its logical and physical components including storage subsystems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	Mapping to POs(1-12)/ PSOs(13-14)		
	Substantial	Moderate	Slight

		Level (3)	Level (2)	Level (1)
CO-1	Explain storage architecture Its logical and physical components of a storage infrastructure and RAID techniques.	1	-	-
CO-2	Describe the intelligent storage systems including different networking technologies.	2	-	12
CO-3	Describe the different network attached storage systems its components.	1	-	-
CO-4	Explain the different back up technologies.	1		
CO-5	Describe the storage security aspects and explain the different parameters of managing and monitoring storage infrastructure.	1	-	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	3.0				-	-	-	-	-	-	1.0	-	-

Prerequisites:

- 1) Computer Networks

Contents:

Unit-I

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data center Infrastructure, Virtualization and cloud computing. Data Center Environment: Application, Database Management System (DBMS), Host(compute), Connectivity, Storage, DiskDrive Components, DiskDrive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, DiskNative Command Queuing, Introduction to Flash Drives.

08 Hrs

Unit-II

Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of intelligent Storage Systems, Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FCSAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FCSAN Topologies, Virtualization in SAN.

08 Hrs**Unit-III**

Network-Attached Storage: General-purpose Servers versus NAS Devices, benefits of NAS, File Systems and network File Sharing. Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, factors Affecting NAS Performance, File-Level Virtualization, Object-Based and unified Storage: Object-Based Storage Devices, Content- Addressed Storage.

08 Hrs**Unit-IV**

Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operation, Backup Topologies, Backup in NAS Environments, Backup Targets, Data De-duplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.

08 Hrs**Unit-V**

Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities.

07 Hrs**Reference Books:**

- 1) EMC² : Information Storage and Management, Willey India, 2013.
- 2) Marc Farley, "Building Storage Networks", Tata McGrawHill, Osborne, 2001.
- 3) EMC Corporation, Information Storage and Management, Wiley, India. ISBN-13: 978-8126537501, 2012.
- 4) Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.

22UISE632	DevOps	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs): Student will be able to introduce DevOps concepts and architecture of Dev ops, analyze Building the code and deployment.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12) / PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Understand the need and significance of DevOps	2	5	3
CO-2	Analysis of layers in DevOps and its effect on software architecture	2	3	1
CO-3	Design and development of solutions using Dev ops code	3	2,6	1, 12,13,14,
CO-4	Deployment of code to practical problems using DevOps tools	4	5,6	2, 12,13,14,
CO-5	Analysis of workflow issues and their tracking	5	2	4

POs/PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.0	2.2	2.0	2.3	2.0	2.0	-	-	-	-	-	1.0	1.0	1.0

Prerequisites:

1. Linear algebra
2. Statistics and probability

Contents:

Unit-I

Introduction: Introduction to DevOps and Continuous Delivery, Introducing DevOps, Howfast is fast? The Agile wheel of wheels Beware the cargo cult Agile fallacy, DevOps and ITIL. The DevOps process and Continuous Delivery – an over view. The developers, The revision control system, The build server, The artifact repository, Package managers, Test environments, Staging/ production, Release management, Scrum, Kanban, and the delivery pipeline, Wrapping up – a complete example, Identifying bottlenecks.

07 Hrs**Unit-II**

DevOps Architecture: How DevOps Affects Architecture, Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns. The principle of cohesion, Coupling, Back to the monolithic scenario, A practical example, Three-tier systems, The presentation tier, The logic tier, The data tier, Handling database migrations, Rolling upgrades, Hello world in Liquibase, The changelog file, The pom.xml file, Manual installation, Micro services, Interlude – Conway's Law, How to keep service interfaces forward compatible, Micro services and the data tier, DevOps, architecture, and resilience.

08 Hrs**Unit-III**

Building the code : Why do we build code?, The many faces of build systems, The Jenkins buildserver, Managing build dependencies, The final artifact, Cheating with FPM, Continuous Integration, Continuous Delivery, Jenkins plugins, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errors seriously, Robustness.

08 Hrs

Unit-IV

Deploying the Code: Why are there so many deployment systems? Configuring the base OS, Describing clusters, Delivering packages to a system, Virtualization stacks, Executing code on the client ,A note about the exercises, The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with Chef, Deploying with SaltStack, Salt versus Ansible versus Puppet versus PalletOps execution models, Vagrant, Deploying with Docker, Comparison tables, Cloud solutions, AWS,Azure.

08 Hrs**Unit-V**

Issue Tracking: What are issue trackers used for? Some examples of workflows and issues, What do we need from an issue tracker?, Problems with issue tracker proliferation, All the trackers, Bugzilla, Trac, Redmine, The GitLab issue tracker, Jira. Introducing the IoT and DevOps, The future of the IoT according to the market, Machine-to-machine communication, IoT deployment affects software architecture, IoT deployment security, Okay, but what about DevOps and theIoT again? A hands-on lab with an IoT device for DevOps.

08 Hrs**Reference Books:**

- 1) The DevOps Hand Book, Gene Kim, Jez Humble, Patric Debois & John Wills, 1st Edition.
- 2) The Practical Guide to Enterprise DevOps and Continuous Delivery, Julian Fish, 1st Edition.

22UIISO641	Agile Methodologies	(3-0-0) 3
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Contact Hours: 39

Course Objectives: To explore a different method of software development understand how an iterative, incremental development process leads to faster delivery of more useful software. To understand the essence of agile development methods by understand, the principles and practices of extreme programming and to understand the roles of prototyping in the software process, understand the concept of Mastering Agility.

Course Outcomes (COs):

Description of the Course	Mapping to POs (1-12) / PSOs (13-14)
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Outcome: At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Analyse The XP Lifecycle, XP Concepts, Adopting XP.	1	-	12
CO-2	Implement Workon Pair Programming, Root-Cause Analysis and other techniques.	1	4	13
CO-3	Design Planning and Incremental equirements, with Customer Tests.	1	4	12
CO-4	Implement Concepts Eliminate Waste.	2	-	1
CO-5	Determine value to productive systems through Agile methods	4	-	13

PO's	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.5	3.0	-	2.0	-	-	-	-	-	-	-	1.0	1.0	-

Pre-requisites: 1. Knowledge of Software Engineering & Software Testing

Contents:

Unit-I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Analysis of XP merits and demerits.

07 Hrs

Unit-II

Practicing XP: Thinking: Pair Programming, Energized Work, and collaborated method, Informative Workspace, Root-Cause Analysis, Retrospectives.

Collaborating: Trust, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration method, Reporting. Releasing: “Done Done”, No Bugs, Version Control, Continuous Integration, Collective Code Ownership, and Documentation.

08 Hrs**Unit-III**

XP-Planning: Purpose Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slacktechniques, Incremental Design.

07 Hrs**Unit-IV**

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Improve the Process: Project, Analysis Tune and Adapt, out of the box thinking. Rely on People: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People. Eliminate Waste: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

08 Hrs**Unit-V**

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently and fast. **Seek Technical Excellence:** Software Doesn't Exist, it is to be created Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, PursueMastery

08 Hrs**Reference Books:**

- 1) James Shore, Chromatic, “The Art of Agile Development (Pragmatic guide to agile software development)”, O'Reilly Media, Shroff Publishers & Distributors, 1st Edition, 2013.
- 2) Robert C. Martin, “Agile Software Development, Principles, Patterns, and Practices”, Prentice Hall; 1st Edition, 2002.
- 3) Craig Larman, “Agile and Iterative Development A Manger's Guide”, Pearson Education, 1st Edition, India, 2004.

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FinTech

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Contact Hours: 39

Course Learning Objectives (CLOs): To explore various new emerging technologies in financial sectors of business. Enabling future engineers to expertise in implementing newer technologies to excel in financial strategies in different business sectors.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain the fundamentals of Banking Systems and technologies involved	5		1
CO-2	Explain various Machine Learning techniques and applications of Cloud computing to financial strategies and Business cases.		3	
CO-3	Illustrate the use of Blockchain technology and Cryptography to different Business applications	12,4		1
CO-4	Explain the applications of Blockchain architecture to various business cases at global level		12,3	
CO-5	Describe concepts and applications of P2P, Crowdfunding technologies in businesses like Banking, Insurances and other regulatory authorities.	12,5		1

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.0	-	2.0	3.0	3.0	-	-	-	-	-	-	2.6	-	-

Pre-requisites: None

Contents

UNIT I

Introduction To BFSI: BFSI Value chain, How FinTech changed BFSI, Modern

Banking Landscape, Introduction to BankTech, Introduction to InsureTech.
 FINTECH PRIMER: Introduction to the Fintech landscape, FinTech Architecture, FinTech Technologies, Latest Trends and future of FinTech, Applications of FinTech, Use cases of FinTech in banks, Fintech startups, Fintech unicorns and business models

08 Hrs

UNIT II

Machine Learning & AI : Introduction to Machine Learning, ML Algorithms and applications, AI and applications, AI/ML –changing business landscape, AI/ML –in practice, Use cases and applications Introduction to Cloud Computing, Cloud Computing Architecture, Technologies for Cloud, Building Robust, Secure & Scalable APIs, API Economy, Open APIs & Connected Businesses, Use cases

08 Hrs

UNIT III

Blockchain Technology And Infrastructure : Blockchain Foundations, Blocks and Blockchain, the Chain, Nodes and Network, Blockchain in Use, Trust Framework and Consensus Mechanisms, Public, Consortium, Private Blockchains, Blockchain Interoperability Blockchain And Cryptography, Application to Blockchain, Hash Functions, Public Key Cryptography and Signing, Use cases and applications

08 Hrs

UNIT IV

Applications of Blockchain Architecture: Setting up a Private Blockchain Environment, Blockchain and Bitcoin, Example Blockchain Networks and Use Cases, Practical Blockchain Architecture and use-cases III. Payments, Crypto-Currencies & Alternative Finance Crypto-Currencies and ICOs
 Cryptocurrencies Primer, Bitcoin and Applications, Cryptocurrencies and Digital Crypto Wallets, Types of Cryptocurrencies, Cryptocurrencies and Applications, What is an ICO?, Importance of ICO in Alternative Finance, Regulations for Cryptos and tokens Payments -Architecture And Technologies
 Global Payment Ecosystem, Payments Architecture and Setup, Innovation in Consumer and Retail payments, Popular Payments Technology, Blockchain and Cryptocurrencies in Payments, Payment Stacks in India, B2B & B2B2C solutions, Innovative Products in Mobile based, Credit Cards, POS based ecosystem.

08 Hrs

UNIT V

P2P Lending, Crowd-Funding And Infrastructure: Concept of P2P Lending , P2P and Marketplace Lending, P2P Infrastructure and technologies, Concept of Crowdfunding, Crowdfunding Architecture and Technology, P2P and Crowdfunding

unicorns and business models, SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations.

Banktech, Insurtech & Regtech Banktech : Regulatory Framework for Product Pricing, loan origination and servicing, Social media-based profiling, comparison tools and aggregators, Dynamic credit rating, Risk management & underwriting, Using Credit Counsellor Robo/Bot for faster approvals & funding , Utilizing data science tools and machine learning for data mining/ cross sale, Hybrid Lending Products.

07 Hrs

Reference Books:

1. Jaspal Singh, "Financial Technology (FinTech) and Digital Banking in India", 1st Edition, 2022.
2. Poorvi Sharma, "Building the Blocks in Fintech: Future of New DNA in Financial Technology", 1st Edition, 2022.
3. V. Ajantha Devi, Mohd Naved, Aditya Kumar Gupta, "Fintech and Cryptocurrency", 1st Edition, 2023.

CIE and SEE Evaluation (from 2022-23 batch) CIE for Non-integrated Courses: With LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

- Two tests + One Improvement test : (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- CTA: Minimum two components such as assignments, quiz, seminar, written assignment, any technical activity related to course etc. each of 5 marks. Total CTA marks- 10
- CIE= 40(from tests)+10(from CTA) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hour's duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions.

CIE for Integrated Courses: With LTP 2-0-2 and 3-0-2 and 2-2-2

Theory CIE component:

- Two tests + One Improvement test (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- Practical CIE component (CTA): Laboratory component. 5 marks for conduction, regularity, involvement, journal etc. Lab Test -5 marks. A test as per the schedule announced will be conducted at the end for 50 marks and scaled down to 5 marks. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- CIE= 40(from tests) +10(from CTA i.e. lab component) = 50 marks

- SEE: Exam will be conducted for 100 marks with 3 hour's duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions. The questions shall be asked to test practical understanding for maximum of 30 marks.

CIE for AEC/HSMS/SDC Courses: With LTP 1-0-0 for 1 Credit

- CIE for 1 credit AEC/HSMS Courses with LTP 1-0-0
- Two tests + One Improvement test
- 20+20+20 each of one hour duration
- QP pattern for IA: MCQ 15 questions
- Two higher scores from three tests are taken representing 40 marks
- CTA: Minimum two components such as assignments ,quiz, seminar, written assignment , any learning activity related to the course etc. each of 5 marks.
- CIE= 40(from tests)+10(from CTA)= 50 marks
- SEE: Exam will be conducted for 50 marks with 1 hour duration. There will be 50 MCQs. The question paper will contain 10 MCQ questions from each module.