Academic Program: UG

Academic Year 2024-25

Syllabus

VII & VIII 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, Belagavi)

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for VII & VIII 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 stake holders.

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work and
- Trust

DEPARTMENT VISION AND MISSION

Vision:

To develop competent Information Technology Engineers having complete knowledge and skills in contemporary Information Technology practices.

Mission:

- To develop contemporary curriculum in information technology delivered
- To provide facilities for relevant research and expose students to the best
- To inculcate the best moral values and professional ethics in students

Program 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 and team work by providing the environment for exploring current technology trends through collaborative and complementary work ethics

POs and PSOs

PO 1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO 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.

PO 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.

PO 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.

PO 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.

PO 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 legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 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.

PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and Team work:** Function effectively as an individual and as a member or leader in diverse teams and individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 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, and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and 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.

PO 12. **Life-long Learning:** long learning: Recognize the need for and have the Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO 13. An ability to develop logical reasoning, coding skills, analysis and mathematical modeling.

PSO 14. An ability to modify, debug, test and adapt software modules for varied applications.

VII Semester

Course Code	*Course Category	Course Title	Teaching		Examination				
					CIE	Theory (SEE)		Practical (SEE)	
			L-T-P (Hrs/Week)	Credits	Max. Marks	**Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UISC700	PC	Big Data Analytics	3 - 0 - 0	3	50	100	3	-	-
21UISE7XX	PE	Program Elective-4	3 - 0 - 0	3	50	100	3	-	-
21UISE7XX	PE	Program Elective-5	3 - 0 - 0	3	50	100	3	-	-
21UISE7XX	PE	Program Elective -6	3 - 0 - 0	3	50	100	3	-	-
21UISO7XX	OE	Open Elective-2	3 - 0 - 0	3	50	100	3	--	--
21UHUC700	HU	Research Methodology	2 - 0 - 0	2	50	50	2	--	--
21UISL701	PC	Machine Learning and Big Data Analytics Laboratory	0 - 0 - 2	1	50	--	--	50	3
21UISL702	PC	Major Project Phase-1	0- 0 - 4	2	50	--	--	50	3
	Total		**16 - 2 -6**	**20**	**400**	**550**		**100**	

* BS- Basic science ES- Engineering Science HU- Humanities, languages and Management AE- Ability enhancement course PC- Program core

** Semester End Examination conducted for 100 marks will be reduced to 50 marks

Major project phase-1: In this work the students are expected to locate the state of the art technology in his 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 material collection, survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase. The project shall consist of a team of students not more than 4. Each batch shall be assigned with a guide.

Evaluation and rubrics: A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. 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 appointed by COE based on the suggestions by the respective HoD considering the parameters such as problem definition and its relevance, depth of knowledge and work carried out, quality of the report, Presentation & communication and interaction (questions and answers) with preferably equal weightage to all parameters. However, the departments can have little flexibility in the rubrics based on the suitability. The students are required to submit a report on the project carried out.

Internship - II: The students are required to undergo internship in Private industries/R&D organizations/ Centers of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, NGO, MSME, rural internship, innovation cells, entrepreneurial organizations, etc. to get en exposure to the external world for a period of 4-6 weeks in the summer vacation after the completion of VI semester and before the start of VII semester. The students are required to prepare a report on the internship-II undergone.

Evaluation and rubrics: A faculty shall guide and monitor the internship activity of a batch consisting 4 to 6 students. A committee consisting of two faculty members shall evaluate the internship work considering the parameters such as nature and extent of exposure to the external engineering world, understanding, report preparation, presentation and knowledge gained etc. There is a semester end examination SEE for internship – II. The performance shall be communicated to the CoE office at the end of VII semester and shall reflect in VII semester grade card.

Program Electives						Open Electives	
PE-3		PE-4		PE-5		OE	
21UISE710	Cloud Computing	21UISE720	Mobile Computing and 5G Technologies	21UISE730	Deep Learning	21UISO740	Data Science
21UISE711	Natural Language Processing	21UISE721	Information Storage Management	21UISE731	Block Chain Management	21UISO741	Generative Al and Large Language Models
21UISE712	Data Compression	21UISE722	Virtual Reality and Augmented Reality	21UISE732	Network Security and Cryptography	21UISO742	Agile Methodologies

VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
					CIE	Theory (SEE)		Practical (SEE)	
			L-T-P (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UISL800	PC	Technical Seminar/Independent study	0 - 0 - 2	1	50	--	--	--	--
21UISL801	PC	Major Project Phase-2 (In Industry/college/ through internship)	0-0 -18	9	50	--	--	50	3
21UISL802	PC	Internship – 2	4 - 6 weeks	3	50	--	--	50	3
	Total		**0– 0 - 20**	**13**	**100**		**--**	100	**--**

VII Semester

21UISC700	Big Data Analytics	(3-0-0) 3

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	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	2.5	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. **07 Hrs**
NoSQL: Key-Value Databases, Column Family Data bases, Graph Databases, Neo4j.

Unit-III

Data Acquisition: Data Acquisition Considerations, Publish -Subscribe Messaging Frameworks, Big Data Collection Systems, Messaging Queues, Custom Connectors. **08 Hrs**
Big Data Storage: HDFS, HDFS Architecture, HDFS Usage Examples.

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 Madisetti, 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) Eric Sammer, "Hadoop Operations", 1st Edition, O'Reilley, 2012.
4) VigneshPrajapati, Big data analytics with R and Hadoop, 1st Edition, SPD 2013.

21UHUC700	Research Methodology	(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	-	-	-

Prerequisites:

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 **05 Hrs**

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

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. **05 Hrs**

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

Unit-III

Data Collection: Collection of primary data, observation method, interview method, collection of data through questionnaires. 0**6 Hrs**

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

Unit-IV

Meaning and conception of IPR, competing, rationale for protection, international conventions, world court. **05 Hrs**
Copy right: 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

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 **05 Hrs**

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.

Reference Books:

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

21UISL701	Machine Learning Big Data Analytics	(0-0-2) 1

Contact Hours: **26**

Course Learning Objectives (CLOs): Students will be exposed to the concepts of managing Big Data, Data mining principles and techniques. They also learn to use open source tools for handling large data.
This course will enable students to make use of Data sets in implementing the machine learning algorithms and implement the machine learning concepts and algorithms in any suitable language of choice

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** the concept of Hadoop /Mongo DB for the storage of big data	1, 5	2	12
CO-2	**Apply** the Map Reduce techniques to analyze the large data.	1, 5	2,13,14	12
CO-3	**Design** and **Apply** the algorithms for big data analysis using machine learning techniques.	1, 5	2, 3,13,14	8, 10, 12
CO-4	**Use** appropriate techniques and tools to solve actual Big Data problems	1	2, 3,5,13,14	6, 10

CO-5	**Demonstrate** data pre-processing tasks for the given dataset.	1,2	5,13,14	8,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.2	2.0	-	2.6	1.0	-	1.0	-	1.0	-	1.0	2.0	2.0

Prerequisites:

1. Knowledge of data structure, data bases and basic statistics.
2. Knowledge of Programming languages (Python/ R language/java).

List of Programs :

1) Install, configure and run Hadoop and HDFS
2) Implement word count / frequency programs using MapReduce
3) Implement an MR program that processes a weather dataset
4) Implement Linear and logistic Regression
5) Implement SVM / Decision tree classification techniques
6) Implement clustering techniques
7) Visualize data using any plotting framework
8) Implement an application that stores big data in Hbase / MongoDB / Pig sing Hadoop / R
9) To apply different data pre-processing techniques to the given data set.
10) Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
11) Find the principal components for the given feature set using eigen vector and covariance matrix.
12) Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Reference books:

1) Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.

2) Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, —”An Introduction to Statistical Learning with Applications in R‖”, Springer Publications, 2015(Corrected 6th Printing).

3) Hadley Wickham, ‖ggplot2 – “Elegant Graphics for Data Analysis‖”, Springer Publications, 2nd Edition, 2016.

4) Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.

21UISL702	Major Project Phase – I	(0-0-4) 2

Contact Hours: **52**

Course Learning Objectives (CLOs): Understand the domain, analyze through Modeling and Implementation through state of the art technology available. Know Software Engineering Principles: Modeling, Estimation, Design standards and architectural issues through use of Standards etc. To write modular programs and handle exceptions to provide reliable solutions. To test and verify the programs for different scenarios.

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** an ability to work in teams and manage the conduct of the research study and Summarize literature review for a given topic.	2, 4, 9	1, 8	12
CO-2	**Identify** problem from literature review.	2	1	12
CO-3	**Define** objectives for the problem and decide on methodology.	-	1, 2	-
CO-4	**Compare** and contrast the several existing methods for solving the chosen problem.	2, 3	5, 13, 14	6, 12
CO-5	**Demonstrate** the use of presentation techniques for effective communication and demonstration of ethics and societal concern in the given solution.	5, 6, 7, 10	8	11, 12
CO-6	**Analyze** requirement of solution for the given problem with teamwork and multidisciplinary approach.	9, 11, 13	3, 8, 14	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.0	3.0	3.0	3.0	3.0	2.0	3.0	2.0	3.0	3.0	2.0	1.0	2.0	2.0

Prerequisites:
Different programming languages / tools.

Contents:

Major project phase-1 in which the students are expected to locate the state of the art technology in his 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 material collection, survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase. The project shall consist of a team of students not more than 4. Each batch shall be assigned with a guide. A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. The weight age 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 appointed by COE based on the suggestions by the respective HoD.

General Instructions to Students:

1) Students are expected to perform extensive literature survey, identify problem statements and prepare synopsis in consultation with project guide/supervisor. Students are expected to submit synopsis- Initial (Registration Phase-1) approved by project guide, to the project coordinator as per the schedule notified. A copy is to be maintained with students and the guide. This registration/ Initial synopsis contains the description of the project concept created and acts as a base line for design and Implementation of the system.
2) Notification/schedules and evaluation procedures will be sent to all students in the Google groups created in the department.
3) Evaluation of problem statement/synopsis-Initial (registration phase-1), Literature Survey and SRS (Requirement Analysis Phase-1) are done in the 7th semester.

Sl No	Parameters for Assessment	% of weightage for CIE and SEE
P1	Project Synopsis/ Proposal Evaluation	15
P2	Literature survey/Technology used / Architectural design	15
P3	Requirement Analysis (SRS)	15
P4	Design methodology/Demonstration of tool used for designing	10
P5	Implementation modules	15
P6	Discussion of test cases /Project demonstration	15
P7	Project Report(phase-1 and Phase-2)	10
P8	Paper Publication/Presentation	05

21UISE710	Cloud Computing	(3-0-0) 3

Contact Hours: **39**

Course Learning Objectives (CLOs): Cloud computing is one of the hottest technical topics today, with broad-ranging effects across IT, Information Architecture, Business, Software Engineering, and Data Storage. It covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, Software as a Service, and Physical Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc.

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** the architecture and infrastructure of cloud computing.	1, 2	-	12
CO-2	**Explain** the core issues of cloud computing.	1	4	12
CO-3	**Choose** the appropriate technologies, algorithms, and approaches for the cloud related issues.	2	4, 5	13, 14
CO-4	**Illustrate** the appropriate cloud computing solutions and recommendations according to the applications used.	1	4	13, 14
CO-5	**Illustrate** recent advances in cloud computing.	1, 2	13, 5	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	3.0	-	2.0	2.0	-	-	-	-	-	-	1.0	1.33	1.0

Prerequisites:

1) Programming in C++ / Java
2) Computer Networks.
3) Web 2.0

Contents:

Unit-I

Introduction to Cloud Computing: Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud-based Services & Applications

Cloud Concepts & Technologies: Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing. **08 Hrs**

Unit-II

Cloud Services & Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open Source Private Cloud Software

Hadoop & Map Reduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, and Hadoop Cluster Setup. **07 Hrs**

Unit-III

Cloud Application Design: Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Introduction, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes **08 Hrs**

Unit-IV

Python for Cloud: Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for Map Reduce, Python Packages of Interest, Python Web Application Framework - Django, Designing a RESTful Web API.

Cloud Application Development in Python: Design Approaches, Image Processing App, Document Storage App, MapReduce App, Social Media Analytics App **08 Hrs**

Unit-V

Introduction to advanced topics: Multimedia Cloud, Cloud Application Benchmarking & Tuning, Cloud Security, Cloud for Industry, Healthcare & Education, Containers, Dockers, and Kubernetes **08 Hrs**

Reference Books:

1) Arshadeep Bahga and Vijay Madisetti, “Cloud Computing: A Hands-On Approach”, Universities Press India, 2014.

2) Dan C Marinescu, "Cloud Computing Theory and Practice", 1st Edition, Elsevier (MK) 2013.

3) RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing Foundations and Applications Programming", 2nd Edition, Morgan Kaufmann, 2013.

4) Tom White "Hadoop: The Definitive" 4th Edition, O'Reilly, 2015

21UISE711 Natural Language Processing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Interpret how speech and language technology relies on formal models to capture knowledge, and language processing deals with subparts of words and illustrate the way N-gram tool is used for spelling and pronunciation processing, and part-of-speech tagging mechanism using various categories.

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 NLP fundamentals and different approaches to build NLP Models.	3	1,2	12
CO-2	**Illustrate** the different approaches of text representation in NLP.	-	2,3	1
CO-3	**Describe** text classification and interpretation of NLP Models.	-	1,2	3
CO-4	**Build** NER system required for Information Extraction.	3,4,5	13,14	12
CO-5	**Evaluate** various NLP models using BERT.	3,4,5	13,14	-

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	1.6	2.0	2.4	3.0	3.0	-	-	-	-	-	-	1.0	2.0	2.0

Pre-requisites: Knowledge of Formal Languages**,** Machine learning and Python

Contents:

Unit I

NLP-A Primer: NLP in the Real World, NLP Tasks, What is Language?, Building Blocks of Languages, Why is NLP Challenging?, Machine Learning, Deep Learning , Learning , and NLP: An Overview, Approaches to NLP, Heuristics-Based NLP, Machine Learning for NLP, Deep Learning for NLP, Why Deep Learning Is Not Yet the Silver Bullet for NLP, NLP Pipeline. **08 Hrs.**

Unit II

Text Representation: Vector Space Models, Basic Vectorization Approaches, One-Hot Encoding, bag of Words, bag of N-Grams, TF-IDF, Distributed, Representations, Word Embeddings, Going Beyond Words, Distributed Representations Beyond Words and Characters, Universal Text Representations. **08 Hrs.**

Unit III

Text Classification: Applications, A Pipeline for Building Text Classification Systems, OnePipeline-Many Classifiers, Using Neural Embeddings in Text Classification, Deep learning for Text Classification, Interpreting Text Classification models. **08 Hrs.**

Unit IV

Information Extraction: IE Applications, IE Tasks, The General Pipeline for IE, Key phrase Extraction, Implementing KPE, Practical Advice, Named Entity Recognition, Building an NER System, NER using an Existing Library, NER using Active Learning, Practical Advice, Named

Entity Disambiguation and Linking, NEL using Azure API, Relationship Extraction, Approaches to RE. **09 Hrs.**

Unit V

BERT: Starting Off with the BERT, A Primer on Transformers, Understanding the BERT Model, Getting Hands-On with BERT. **08 Hrs.**

Reference Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana, “Practical NLP: A Comprehensive Guide to Building Real-World NLP Systems“,O‘Reilly, 2020.
2. Sudharsan Ravichandiran, “Getting Started with Google BERT: Build and Train State-of-the-Art NLP Models using BERT”, Packt

Publishing Ltd,2021.

3. Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit”, 1st Edition, O‘Reilly 2009.

4. Raymond S. T. Lee, “Natural Language Processing: A Textbook with Python Implementation”, Springer Nature, 2023.

21UISE712	Data Compression	(3-0-0) 3

Contact Hours: **39**

Course Learning Objectives (CLOs): The course provides an overview of classical and modern techniques and algorithms of various types of data compression. It covers statistical and dictionary methods, lossless and lossy compression algorithms in graphics, video and audio compression

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	Analyse the various compression techniques and information theory	1	3	
CO-2	Design and analysis of various coding techniques	2	13,14	1,12
CO-3	Design and analysis of various lossless compression methods	2	1,5,13	3,12
CO-4	Discuss wavelet compression and audio coding methods	3	5	2,12,13,14
CO-5	Analyse Video compression techniques	3	13	2,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.0	2.0	3.0		2.0							1.0	1.75	1.5

Pre-requisites:

1. **Linear Algebra**
2. **Programming Language**

Contents:

Unit-I

Introduction : Compression techniques, modeling and coding mathematical preliminaries for lossless compression: A brief introduction to information theory, models, coding, algorithmic information theory, minimum description length principle **08 Hrs**

Unit-II

Huffman Coding: The Huffman coding algorithm, non binary Huffman codes, adaptive Huffman coding, golomb codes, rice codes, Tunstall codes, application of Huffman coding. **08 Hrs**

Unit-III

Lossless Image Compression: Introduction, CALIC, JPEG-LS, multi resolution approaches, facsimile encoding, MRC-T.44.**Mathematical Preliminaries For Lossy Coding:** Introduction, distortion criteria, information theory revisited, rate distortion theory, models. **08 Hrs**

Unit-IV

Wavelet Based Compression: Introduction, wavelets, multi resolution analysis and scaling function, implementation using filters, image compression, embedded zero tree coder, set partitioning in hierarchical trees, JPEG zero. **08 Hrs**

Audio Coding: Introduction , MPEG coding, MPEG advanced audio coding, Dolby AC3(DOLBY DIGITAL) other standards.

Unit-V

Video Compression: Introduction, motion compensation, video signal representation, ITU-T recommendation H.261, model based coding, asymmetric applications, The MPEG1 video standard, The MPEG-2 video standard, ITU-T recommendation H.263, ITU-T recommendation H.264, MPEG-4 part 1.0 advanced video coding, MPEG-4 part 2 , packet video, ATM networks. **07 Hrs**

Reference books:

1. Khalid Sayood, “Introduction to Data Compression”, 5th Edition,2018 Elsevier Inc.
2. David Salomon, ” A concise introduction to data compression”, 1st Edition , 2008,Springer.
3. Colt McAnlis, Aleks Haecky, “Understanding Compression: Data Compression for Modern Developers”, 1st Edition , O’Really Media,2016
4. David Salomon, Giovanni Motta, D. Bryant, “Hand book on Data Compression”, 5th Edition, Springer, 2010.

22UISE720 Mobile Computing with 5G Technology (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): The main objective is to understand the basic concepts of mobile computing, be familiar with the network protocol stack, learn the basics of mobile telecommunication system, and Gain knowledge about different mobile platforms and application development.

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 5G spectrum requirement, its channel model and use cases	1, 2	3	12
CO-2	Familiarize with 5G architecture options and physical layer concepts	1, 2	-	12
CO-3	Examine the multicarrier techniques and new waveform options for 5G communication	-	2	-
CO-4	Illustrate the concept of network slicing and V2V Communication	1	-	-
CO-5	Interpret the Interference and Mobility management in 5G networks	1	2	13,14

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	3.0	2.5	2.0	-	-	-	-	-	-	-	-	1.0	1.0	1.0

Contents:

Unit-I

5G Radio Spectrum: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.

5G Channel Model: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling.

5G Use Cases And System Concept: Use cases and requirements, 5G system concept. **08 Hrs**

Unit-II

Radio Interface Architecture: 5G architecture options, core network architecture, RAN architecture.

5G Physical Layer: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming). **08 Hrs**

Unit-III

5G Radio-Access Technologies: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple access **07 Hrs**

Unit-IV

Introduction To 5G Network Slicing: Network Slicing, E2E Slicing, SDN and NFV Slicing

Vehicular Communications: From V2V to AV2X, key standards, VC architectures, V2X Use cases **08 Hrs**

Unit-V

Mobility And Handoff Management In 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G. **08 Hrs**

Reference Books:

1) Afif Osseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
2) Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, Taylor & Francis Group, 1st Edition, 2018
3) Harri Holma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons First Edition,2020
4) Gordon L. Stuber, "Principles of Mobile Communication", KLUWER ACADEMIC PUBLISHERS, 2nd Edition, 2002

21UISE721	Information 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 Level (3)	Moderate Level (2)	Slight 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, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, Disk Native Command Queuing, Introduction to Flash Drives. **08 Hrs**

Unit-II

Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisionin, Types of intelligent Storage Systems, Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FC SAN 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) EMC^2 : 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, August 2012.
4) Robert Spalding, “Storage Networks: The Complete Reference“, Tata McGraw Hill, Osborne, 2003.

21UISE722	Virtual Reality and Augmented Reality	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLO's): The objective of the course is to provide an understanding to the students the fundamentals of virtual reality systems. Aim is to summarize the 3D interaction techniques and its importance to provide design guidelines to develop and analyze the real world applications of virtual reality.

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Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** fundamentals of virtual reality systems	1	2	
CO-2	**Summarize** the hardware and software of the virtual reality.	1	2	
CO-3	**Explain** the 3D Interaction Techniques design guidelines for a virtual reality system.		3,13,14	
CO-4	**Summarize** the design guidelines for a virtual reality system		13,14	3
CO-5	**Analyze** the applications of virtual reality.	4		

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	1.5	3.0	-	-	-	-	-	-	-	-	1.0	1.0

Contents

Unit-I

Virtual Reality and Virtual Environments: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for virtual reality, benefits of virtual reality. **08 Hrs**

Unit-II

Hardware Technologies For 3D User Interfaces- Visual Displays, Auditory displays, choosing Output devices for 3D User Interfaces. **3D User Interface Input Hardware**: Input device characteristics, Desktop input devices, Tracking Devices, 3D **08 Hrs**

Mice, Special Purpose Input Devices

Software Technologies: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occludes, Lights and Cameras, VR toolkits

Unit-III **08 Hrs**

3D Interaction Techniques: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Way finding, User Centered Way finding Support, Environment Centered Way finding Support, Evaluating Way finding Aids

Unit-IV

Designing and Developing 3D User Interfaces: Strategies for Designing and Developing Guidelines and Evaluation. **Advances in 3D User Interfaces:** 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology,. **08 Hrs**

Unit-V

Virtual Reality Applications: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training. **07 Hrs**

Reference Books:

1) Kelly S. Hale Kay, M. StanneyHandbook of Virtual Environment : Design , CRC Press, 2nd Edition, 2015.
2) Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3) Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
4) Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.

21UISE730 Deep Learning (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Deep Learning is one of the most highly sought after skills in AI. In this course, students will learn the foundations of Deep Learning, understand how to build neural networks, and learn how to lead successful machine learning projects.

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	**Write** program using Scikit-learn, TensorFlow, PyTorch, Keras, etc.	1, 2	3, 13, 14	5, 12
CO-2	**Build, train, and apply** fully connected deep neural networks; implement efficient neural networks; and apply deep learning to real time applications.	5	1, 2	4, 12
CO-3	**Implement** Time Series Forecasting and Recurrent Neural Networks	1, 3, 5,	13, 14	6
CO-4	**Demonstrate** object detection, image segmentation, and visual interpretation of convolutions.	1	2	6, 13, 14
CO-5	**Apply** deep learning knowledge and expertise to a real-world challenge. Develop and test a deep learning model.	4	1	12, 13, 14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.5	2.3	2.5	1.0	1.5	1.0	-	-	-	-	-	1.0	1.5	1.5

Prerequisites:

1) Linear algebra
2) Statistics and probability

Contents:

Unit-I

Introduction to Deep Learning: Discover the basic concepts of deep learning such as neural networks and gradient descent. Implement a neural network in NumPy and train it using gradient descent with in-class programming exercises. Build a neural network to predict student admissions.

Introduction to PyTorch and TensorFlow **07 Hrs**

Unit-II

Deep Learning with PyTorch and TensorFlow: Build your first neural network to classify images of clothing. Work through a set of Jupyter Notebooks to learn the major components of PyTorch. Load a pre-trained neural network to build a state-of-the-art image classifier.

Convolution Neural Networks: Build Convolution Neural Networks for state-of-the-art computer vision applications. Train a convolution network to classify dog breeds from images of dogs. **09 Hrs**

Unit-III

Time Series Forecasting: Learn how to perform time series forecasting using deep learning and TensorFlow.

Recurrent Neural Networks: Build recurrent neural networks with PyTorch that can learn from sequential data such as natural language. Implement a network that learns from Tolstoy's Anna Karenina to generate new text based on the novel. **08 Hrs**

Unit-IV

Natural Language Classification: Implement a recurrent neural network that can classify text. Use your network to predict the sentiment of movie reviews.

Deploying with PyTorch / PyTorch : Build a chatbot and compile the network for deployment in a production environment. **08 Hrs**

Unit-V

Introduction to TensorFlow Lite: Learn how to deploy your models on Android, and IoT devices.

Capstone Project with Deep Learning using scikit-learn, TensorFlow, pytorch, etc. **07 Hrs**

Reference books:

1) Ian Good felllow, YoshuaBenjio, Aaron Courville, Deep Learning-, The MIT Press 2016.
2) Andrew W. Trask ,Grokking Deep Learning, Manning Publications, 2019.

3) Richard O. Duda, Peter E. Hart, David G. Stork, John Pattern Classification- Wiley & Sons Inc.
4) Chirstopher Bishop, Pattern Recognition and machine Learning 2007.

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21UISE731	Block Chain Management	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To help the students design and develop secure solution to provide confidentiality and integrity, user authentication, secure network and transport layer communication, secure wireless communication, defeat vulnerabilities and electronic payment. Block chain is a distributed, decentralized public ledger. Block chain simply means chain of blocks. It means digital information ("the block") stored in a public database ("the chain"). Blocks on a Blockchain have three parts:

First Blocks show information like date, time and amount. Second Blocks store information about who carried out the transaction by using digital signature instead of identifiable names. Third Blocks store information that makes them different from other blocks by the use of a unique code called HASH.
This fundamental course covers the theory of Block chain and standard protocols for data communications and network security. Topics that may be covered include Supply Chain and Logistics, digital signatures, message authentication codes, hash functions, etc. An examination of network security defenses and countermeasures are also covered.

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** and inspect vulnerabilities In Block chain Concepts.	1	-	12
CO-2	**Apply** and **analyze** different cryptographic algorithms for secure data transmission using recent Tools. Block chain Application Components.	5	2	-
CO-3	**Analyze** the basics of Ethereum Development Tools	-	2	14
CO-4	**Discuss** electronic payment with help of Authentication and Authorization. Externally Owned Account(EOAs), Key pairs	-	-	2
CO-5	**Implementing** the Cryptographic algorithms	-	-	5,13

	Compiling and Deploying a Contract. Working with EOA Accounts			

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

Contents:

Unit-I

Introduction: Block chain Concepts, Block chain Evolution, Block chain structure, Block chain characteristics, Block chain Application example Escrow, Block chain stack, Block chain Decentralized Computation Platform-Ethereum, Decentralized Storage platform-Swarm, Decentralized Massaging platform-Whisper, Smart Contracts, Decentralized Applications, Tools and Interfaces, from Web 2.0 to the next generation decentralized web, Domain specific Block chain Applications, FinTech, Internet of Things, Industrial and Manufacturing, Registry of Assets and Inventory, energy, Supply Chain and Logistics, Records and Identities, Healthcare, Block chain Benefits and Challenges. **08 Hrs**

Unit-II

Blockchain Application Templates: Block chain Application Components, Blockchain Application Components, Design Methodology for Block chain Applications, Blockchain Application Templates: Many-to-One, Many-to-One for IoT Applications, Many-to-Many or Peer-to-Peer, One-to-One for Financial Applications. **08 Hrs**

Unit-III

Block chain Components and Applications: Setting up Ethereum Development Tools, Ethereum Clients, Go-Ethereum Clien, Python Ehtereum Client(Python App), Ethereum Languages, Solidity, TestIRPC, Mist Ethereum Wallet, MetaMask, Web3 JavaScript API, Truffle. **07 Hrs**

Unit-IV

Ethereum Accounts: Ethereum Accounts, Externally Owned Account (EOAs), Keypairs, Working with EOA Accounts, Creating Account, Listing Accounts, Updating Accounts, Checking Balance, Account Transactions, Working with Contract Accounts, Computing and Deploying Contract, Interacting with Contracts, Installing or Watching a Contract. **08 Hrs**

Unit-V

Smart Contracts: Structure of a Contract, Setting up and Interacting with a contract using Get Client, Compiling and Deploying a Contract, Interacting with a contract, Gas, Logs, Events, Setting up and Interacting with a Contract Using Mist Wallet, Compiling and Deploying Contract, Interacting with a Contract, Smart Contract Examples, Event Registration Contract, Voting Contract, Name Registry Contract, IoT Smart Switch Contracts, Smart Contract Patterns, Withdrawal, Access Restriction, Rejecter, Circuit Breaker, Allow Once per Account, Case Study. **08 Hrs**

Reference Books:

1) ArshdeepBahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach" Universities Press, 1st Edition, 2019.

2) Kumar Saurabh and Ashutosh Saxena, "Blockchain Technology Concepts and Applications", 1st Edition.

3) The Block chain Developer A Practical Guide for Designing, Implementing, Publishing, Testing and Securing Distributed Blockchain Based Projects by EladElrom, 1st Edition.

21UISE732 Network Security and Cryptography (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course is designed to provide theoretical concepts used in cryptography and to introduce the students to various cryptographic algorithms and techniques used for implementing data security and protection. This course also discusses common web application security vulnerabilities.

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** various types of security attacks, security mechanisms, security services and classical encryption techniques and **Make** use of Symmetric and Asymmetric encryption techniques to solve cryptographic problems.	1		12
CO-2	**Illustrate** modern block ciphers.		2	
CO-3	**Describe** the concepts of Public key cryptography.	1	2	12
CO-4	**Describe** the concepts of	1		2

	message authentication codes, hash functions and digital signing techniques for ensuring secure transactions			
CO-5	**Discuss** security services in Application and Network layers	1,8	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	3	2	2					3				1		

Pre-requisites: Computer Networks

Contents:

Unit I

Introduction to Cryptography, OSI security architecture: Security Services, Mechanisms and attacks, Network security model. Classical Encryption techniques - Symmetric cipher model, substitution techniques, transposition techniques. Steganography. **07 Hrs.**

Unit II

Symmetric Key Cryptography : Mathematics of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclids algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard RC4 Key distribution. **09 Hrs.**

Unit III

Public key cryptography: Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing –Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography **08 Hrs.**

Unit IV

Hash Functions and MAC: Properties of hash functions, birthday attack, hashcash, Message Authentication Code Algorithms, MAC **08 Hrs.**

protocols: HMAC, CMAC.

Digital Signatures: Classification of signature schemes: RSA signature, Digital Signature Standard, One time signature schemes, Attacks on Digital Signatures, Blind Signatures

Unit V

Security Practice and System Security: Email Security: Security Services for email, Attacks possible through email, Establishing keys privacy, authentication of the source, Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME.

IP Security: Overview of IPSec, Authentication Header, Encapsulation Security Payload (ESP), Internet Key Exchange. **07 Hrs.**

Reference Books:

1. William Stallings, "Cryptography and Network Security," 6th Edition, Pearson Education, March 2013.
2. Behrouz A. Forouzan, "Introduction to Cryptography and Network Security", Tata McGraw-Hill Publishing 2nd Edition (2011).
3. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.
4. Manuel Mogollon, "Cryptography and Security Services – Mechanisms and Applications", Cybertech Publishing, 2008.

21UISO740	Data Science	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course will enable students to define data science and its fundamentals demonstrate the process in data science, Explain machine learning algorithms necessary for data sciences, Illustrate the process of feature selection and analysis of data analysis algorithms and Visualize the data and follow of ethics.

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	**Define** data science and its fundamentals	-	-	4

CO-2	**Demonstrate** the process in data science	-	3	-
CO-3	**Explain** machine learning algorithms necessary for data sciences	-	3	-
CO-4	**Illustrate** the process of feature selection and analysis of data analysis algorithms	-	2	-
CO-5	**Visualize** the data and follow of ethics	1	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-	-	-

Prerequisites: Database Management Systems

Contents:

Unit-I

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, - Introduction to R **08 Hrs**

Unit-II

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, kNearest Neighbors (k-NN), k-means **08 Hrs**

Unit-III

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web. **10 Hrs**

Unit-IV

Feature Generation and Feature Selection (Extracting Meaning From Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system. **08 Hrs**

Unit-V

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists **07 Hrs**

Reference Books:

1) Doing Data Science Cathy O'Neil and Rachel Schutt Straight Talk From The Front line. O'Reilly 2014.

2) Mining of Massive Datasets. v2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press 2014.

3) Machine Learning: A Probabilistic Perspective Kevin P. Murphy 2013.

4) Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.

21UISO741 Generative AI and Large Language Models (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Explain the fundamental concepts, principles and technology of generative AI. Describe the generative AI landscape and its practical applications across various industries. Apply prompt engineering effectively from understanding its techniques and patterns. Gain hands-on experience building simple generative AI applications. Discuss emerging trends and future directions in generative AI, including ethical considerations and challenges associated with its use.

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** Generative AI and explain how Generative AI works	1, 2		12
CO-2	**Improving** LLM performance through Parameter Efficient Fine-Tuning	1, 2		

CO-3	**Designing** LLM Applications		**3, 4, 5, 6**	**13,14**
CO-4	**Deployment** of LLM application and deployment.		**3, 4, 5, 6**	**13,14**
CO-5	**Survey** on Real-world applications of Generative Al and LLMs		**8**	**12**

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

Pre-requisites: 1. AI and ML

Contents:

Unit-I

Transformers Architecture: Understanding the key components and its role in language generation. Prompt Engineering and Instruction Fine-Tuning: Techniques to guide LLMs in generating desired outputs. **07 Hrs.**

UNIT-II

Parameter Efficient Fine-Tuning (PEFT) for optimized model adaptation. Reinforcement Learning with Human Feedback: Enhancing LLM performance through human interaction. **08 Hrs.**

UNIT-III

LLM-powered Applications: Text and Image Generation, creative applications. Retrieval-Augmented Generation (RAG) and its potential Generative Image Models such as AutoEncoders, GANs, Diffusion Models, OpenAl CLIP etc. **08 Hrs.**

UNIT-IV

Lang Chain: Framework for developing applications using LLMs Training & Deployment Strategies for LLMs. **08 Hrs.**

UNIT-V

Responsible Al in Generative Al: Ethical considerations and mitigating biases. Use Cases & Case Studies: Real-world applications of Generative Al and LLMs. **08 Hrs.**

Reference Books:

1. Ben Auffarth, “Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs”, Packt, 2024
2. Numa Dhamani, Maggie Engler, “Introduction to Generative AI, Manning”, 2024
3. Joseph Babcock,Raghav Bali, “Generative AI with Python and TensorFlow 2”, Packt, 2024

4. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, 2023

21UISO742	Agile Methodologies	(3-0-0) 3

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 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	**Analyse** The XP Lifecycle, XPConcepts, Adopting XP.	1	-	12
CO-2	Implement Work on Pair Programming, Root-Cause Analysis and other techniques.	1	4	13
CO-3	**Design** Planning and Incremental requirements, 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", No Bugs, Version Control, Continuous Integration, Collective Code Ownership, Documentation. **08 Hrs**

Unit-III

XP-Planning: Purpose Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack techniques, 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, Pursue Mastery **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.

VIII SEMESTER

21UISL800	TECHNICAL SEMINAR	(0-0-2) 1

Contact Hours: **26**

Technical Seminar: The students are expected to learn how to carry out literature survey to locate the state of the art technology in engineering domain of their interest. They are required to carry out selection of an emerging topic beyond the syllabus relevant to the branch of study, understand the concept, analyze and present effectively for 15-20 minutes followed by 5 minutes of questions and answers before their classmates and faculty. They can also present the technical innovative/novel work carried out in the laboratory. They are also required to learn the effective communication and modalities of technical interactions. Further, they have to submit the seminar material in the form of a paper in IEEE format. All the students are required to attend all the session throughout the semester.

Course Outcomes:

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 an ability to present the work carried out both in written and oral form.	10		
CO-2	Demonstrate an ability to incorporate rapid changes in technology by undergoing life-long learning	12	2	

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level		2.0								3.0		3.0		

Procedure to conduct technical Seminar:

- All the students are informed to select a topic from the field of their interest from their branch or relevant to their branch and register the topic with the faculty (ies) In charge of Seminar.
- Two faculty members assigned to carry out this activity. The faculty members prepare the schedule of the seminar spread over the entire semester and display the same in the notice board.
- Change of seminar topic is not allowed once registered, however in the case of genuine reasons only once change of topic may be permitted.
- Based on the number of hours mentioned in the scheme, 4-6 students shall present the seminar in one slot of 2/3 hours.
- The faculty members shall conduct the seminar session every week as per the schedule in the slot mentioned on the time table and carry out the evaluation.
- Attendance is compulsory for all the students for all the seminars.
- The students are required to submit two hard copies of report not exceeding 6 pages and one soft copy of seminar report one week prior to their date of presentation.
- Report shall be in IEEE format viz A4 size paper, Title: Bold, Times new Roman Font 14, Sub heading & Body of the text: Times new Roman font 12. Margin for left should be 1 ½.
- Student name, USN, seminar date should be mentioned on the report.
- Presentation is for about 15-20 minutes, followed by 5 minutes for questions and answers.
- Typical evaluation methodology: The seminar shall be evaluated for maximum 50 marks. The breakup of marks shall be: Presentation: a) 40 marks b) Report: 10 marks.

For presentation, the following points not limited to may be considered.

- Concept, understanding, depth of the knowledge, originality of the topic, Quality of PPT, communication skills etc.
- For report evaluation, the following points not limited to may be considered
- Adherence to IEEE format, relevance of topic, subject depth and originality in writing etc.
- The seminar is aimed at as an educative program for the students. This is because, the students shall listen to 60- 70 seminars on different topics from emerging areas is as good as undergoing a course on latest happenings in the related branch of Engineering.

The departments going for Independent study in place of technical seminar shall plan, prepare the modalities and take the approval from Dean (AP)

The seminar is aimed at as an educative program for the students. This is because, the students shall listen to 60- 70 seminars on different topics from emerging areas is as good as undergoing a course on latest happenings in the related branch of Engineering.

21UISL801	Major Project Phase-2	0 - 0 -18

Contact Hours: **234**

Course Learning Objectives (CLOs): Understand the domain, analyze through Modeling and Implementation through state of the art technology available .Know Software Engineering Principles: Modeling, Estimation, Design standards and architectural issues through use of Standards etc. To write modular programs and handle exceptions to provide reliable solutions. To test and verify the programs for different scenarios.

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, formulate** the problem statement and prepare software requirement specification (SRS)	2, 8, 13	1, 5, 11, 12	7
CO-2	**Design** specification using standard diagrams and tools.	3, 8, 13, 16	1, 5, 11, 12	7
CO-3	**Implement** the system based on design specification using appropriate programming standards, tools, and practices.	8, 14, 16	1, 4, 5, 12	-
CO-4	**Verify and Validate** the given system using standard practices and tools.	8, 15	1, 4, 5, 12	-
CO-5	**Communicate** effectively with and learn from, the experts from different domains.	8, 9, 10	5, 12	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	3.0	3.0	2.0	2.0	-	1.0	3.0	3.0	3.0	2.0	2.0	3.0	3.0

Major project phase- II: This work is normally the continuation from phase –1in which the students are expected to go for material collection, survey, visits, data collection, preliminary design, analysis, model development, code writing, field work etc. The same project team formed for phase –1 will continue the work under the

guidance of the same faculty member. For all the projects, problems may be domain specific or interdisciplinary also in nature. A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. The weightage of marks shall be 50% for the committee and 50% for the guide. In the case of interdisciplinary project work; one faculty from each department will guide the project and assess their department students.

Evaluation and rubrics: There is a viva voce examination which shall be examined by two examiners one internal and one external to the college appointed by COE based on the suggestions by the respective HoD. The evaluation is to be done considering the parameters such as problem definition and its relevance, depth of knowledge, work carried out, quality of the report, Presentation & communication and interaction (question and answers) with preferably equal weightage to all parameters. However, the departments can have little flexibility in the rubrics based on the suitability. The students are required to submit a report on the project carried out.

Reference materials/books: The reference materials for the project work are as listed below but not limited to:

1. Engineering books.
2. Journals.
3. Manuals and data sheets.
4. Software packages.
5. Previous project reports.
6. Product information brochures.
7. Interaction with academia and industrial experts.
8. Internet etc.

Technical Seminar/ Independent study: The students are expected to learn how to carry out literature survey to locate the state of the art technology in engineering domain of their interest. They are required to carry out selection of an emerging topic beyond the syllabus relevant to the branch of study, understand the concept, analyze and present effectively for 15-20 minutes followed by 5 minutes of questions and answers before their classmates and faculty. They can also present the technical innovative/novel work carried out in the laboratory. They are also required to learn the effective communication and modalities of technical interactions. Further, they have to submit the seminar material in the form of a paper in IEEE format. All the students are required to attend all the session throughout the semester.

The departments going for **Independent study** in place of technical seminar shall plan, prepare the modalities and take the approval from Dean (AP).

Evaluation and rubrics: A committee consisting of minimum 3 faculty members shall evaluate for CIE considering the parameters such as topic and its relevance,

depth of knowledge and understanding, quality of the report, Presentation & communication and interaction (question and answers) with preferably equal weightage to all parameters. However, the departments can have little flexibility in the rubrics based on the suitability. The students are required to submit a report on the project carried out.

21UISL802	Internship-2	3-0-0

Contact Hours: 4-6 weeks

Course Learning Objectives (CLOs): The internship module aims to provide the student with a practice-oriented and hands-on working experience in the real world or industry, and to enhance the student's learning experience i.e. to integrate theory and practice. It gives an opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organizational setting. Also, to further develop and enhance operational, customer service, competency in specific areas related to student's area of career interest, skills in research, analysis and other life-long knowledge and skills in a real-world work environment. Through Internship, students can get pre-employment training and the company or organization can assess the performance of the student and offer the student an employment opportunity after his/her graduation, if it deems fit.

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	**Solve** real life challenges in the workplace by analyzing work environment and conditions, and selecting appropriate skill sets acquired from the course.	1, 2	4	12
CO-2	**Communicate and collaborate** effectively and appropriately with different professionals in the work environment.	5,10	8	6,7,11,12
CO-3	**Demonstrate** critical thinking, problem-solving skills and creativity and innovation by analyzing underlying issue/s to challenges.	1,2,3,4,5,13,14	6,7,8	12

CO-4	**Demonstrate** the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s.	1,2,3,4,5,13,14	6,7,8	12
CO-5	**Demonstrate** an ability to work as a professional in a heterogeneous team environment.	9,10,11	8	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	3.0	3.0	2.66	3.0	1.66	1.66	2.0	3.0	3.0	2.0	1.0	3.0	3.0

The students are to undergo internship in Private industries/R&D organizations/Centers of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get exposure to the external world for a period of 4 weeks in the summer vacation after VI sem and before start of VII semester. The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. There is a SEE in which the student shall present his work before a panel of examiners consisting of HoD, Guide and one faculty member during VIII semester. The performance shall be communicated to the COE office and the same shall reflect in the VIII semester grade card.

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.