Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Information Technology

Third Year Scheme & Syllabus

(As per AICTE guidelines, with effect from the Academic Year 2022-23)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Therefore, autonomy for Vidyalankar Institute of Technology is not merely a transition from pre-cooked syllabi to self-designed curriculum. Autonomy curriculum of the Institute offers required academic flexibility with emphasis on industry requirements and market trends, employability and problem-solving approach which leads to improving competency level of learners with diverse strengths. In line with this, the curriculum framework designed is **Choice Based Credit and Grading System (CBCGS)**. Number of credits for each category of courses learnt by learners, internships and projects is finalized considering the scope of study and the ability that a learner should gain through the programme. The overall credits and approach of curriculum proposed is in line with AICTE model curriculum.

The curriculum comprises courses from various categories like basic sciences, humanities and social sciences, engineering sciences, general education and branch specific courses including professional electives and open electives. The curriculum has core courses of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. These courses are completed by third year of the engineering programme that enables learners to prepare for higher education during their final year. Professional elective courses, that begin from third year of programme, offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a salient feature of this curricula ensuring employability. Open Elective courses cover multi-disciplinary, special skill development, project management and similar knowledge that make learner capable to work in industrial environment.
For holistic development of learners, apart from technical courses, Humanities and Social Science courses develop the required soft-skills and attitude amongst learners. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking, Yoga and Meditation, Indian Traditional Knowledge System under General Education category. These general education courses aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses. In addition to this, the curriculum is augmented with Life Enrichment audit courses for knowledge inspiring experience.

Additionally, curriculum provides add-on Honours/Minor degree that involves field/ domain study. Learner can avail this degree by completing requirement of additional 18 credits.

Thus, the academic plan of VIT envisages a shift from summative to formative and competency-based learning system which will enhance learner's ability towards higher education, employability and entrepreneurship.

Chairman, Board of Studies
Department of Information Technology
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Third Year B. Tech. Information Technology **Semester: V**

Course Structure and Assessment guidelines

Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
HS04	Presentation Skills	Theory	1	50	-	-	050
BS12	Engineering Mathematics-V	Theory	3	20	30	50	100
IT09	Automata Theory	Theory+ Tutorial	3	40	20	40	100
IT10T	Data Warehousing & Mining	Theory	2	15	20	40	075
IT10P	Data Warehousing & Mining lab	Practical	1	25	-	25	050
IT11T	Advanced data structure and Algorithm	Theory	2	15	20	40	075
IT11P	Advanced data structure and Algorithm lab	Practical	1	25	-	25	050
IT12T	Software Engineering with WDL	Theory	2	15	20	40	075
IT12P	Software Engineering with WDL lab	Practical	1	25	-	25	050
IT XXT	Professional Elective-1	Theory	2	15	20	40	075
ITXXP	Professional Elective-1 Lab	Practical	1	25	-	25	050
IT46	Minor Project-I	Practical	2	25	-	50	075

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE=End Semester Examination

Professional Elective-1 courses (ITXX)

Course Code	Course Name	Specialization Track Name#
IT21T	Artificial Intelligence	Artificial Intelligence & Machine Learning (AIML)
IT21P	Artificial Intelligence Lab	
IT22T	Advanced Database Management System	Data Analytics
IT22P	Advanced Database Management System Lab	
IT23T	Modern Sensors for IoT	IoT
IT23P	Modern Sensors for IoT Lab	
IT24T	Computer & Network Security	Cyber Security (CSec)
IT24P	Computer & Network Security Lab	

Detailed syllabus of Third Year Semester-V

Course Name: Presentation Skills

Course Code: HS04

Category: Humanities and Social Sciences (HSS)

Preamble:

The course, Presentation Skills, is intended to equip students with the necessary skill-set to help them bridge the gap from the campus to the corporate world. It will help them be industry ready in sync with the program requirements they are pursuing.

Pre-requisites:

NIL

Course Objectives:

- To familiarize students about constructing a personal brand effectively.
- To create engaging and deliver effective business presentation skills by utilizing digital tools.
- To apply communication and strategic planning in business plan pitches and presentations.
- To develop an appreciation for cultural diversity and enhance intercultural communication skills.
- To understand the nuances of storyboarding and storytelling
- To present oneself professionally in interviews, group discussions and various corporate situations.

Course Outcomes:

Learner will be able to:

CO1: Understand the significance of brand-building and apply strategies to construct an effective personal brand.

CO2: Demonstrate proficiency in delivering impactful presentations by utilizing digital tools and applying structured communication principles.

CO3: Proficient in crafting comprehensive business plans by employing persuasive marketing and financial strategies and implementation plans.

CO4: Craft engaging visual stories through storyboarding and storytelling, create compelling video presentations.

CO5: Demonstrate readiness for placements by gaining practice in aptitude tests, HR interviews and GDs, and crafting professional resumes.

CO6: Understand intercultural communication, global citizenship, and respect cultural diversity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	50	-	-	50

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Personal Branding	Introduction to Personal Branding –Purpose, Significance, Benefits and Techniques to build a personal brand, Corporate/Organisational Branding Online identity of Brand on social media Maintenance and Improvement of your Brand Factors affecting your Brand	06
2	Corporate Presentations	Business Presentation Tips, Digital Presentations PAIBOC Model and Minto Pyramid Principles	04
3	Business Plan Presentations	Introduction to Business Plans, Company Overview & Industry Analysis, Persuasive Communication in Marketing Strategy, Operations Strategy in Financial Management	06
4	Storyboarding and Storytelling	Visual Story Telling, Video Presentations Story Structure with images Film and Animation	04
5	Placement Readiness	Mock HR Interviews, Mock GDs, Aptitude Tests, Placement ready resume	06
6	Global Communication	An introduction to inter-cultural communication, Introduction to languages and cultures, Global media in mass communication Tips to become a global citizen Respecting cultural diversity	04
Total			**30**

Suggested List of Practical:

1. Personal Branding
2. Personal Branding
3. Personal Branding
4. Corporate Presentations
5. Corporate Presentations
6. Business Plan Presentations
7. Business Plan Presentations
8. Business Plan Presentations
9. Storyboarding and Storytelling
10. Storyboarding and Storytelling
11. Placement Readiness
12. Placement Readiness
13. Placement Readiness
14. Global Communication
15. Global Communication

Suggested List of Assignments:

1. Personal Branding (Individual)
2. Corporate Presentations (Group)
3. Business Plan Presentations (Group)
4. Storyboarding and Storytelling (Group)
5. Global Communication (Individual)

Skill Set:

1. Placement readiness and Personal branding techniques (H)
2. Corporate presentation and Business Plan techniques (M)
3. Inter-cultural communication to handle industry clients (H)

Tool Set:

1. Software for visual storytelling, film and animation
2. Software for digital presentations

Recommended Online Courses:

1. Introduction to Personal Branding - https://www.coursera.org/learn/personal-branding
2. Strategic Self-Marketing and Personal Branding - https://www.coursera.org/learn/self-marketing
3. Learn to Storyboard for Film or Animation - https://www.udemy.com/course/storyboard-for-film-or-animation/
4. Powerful Tools for Teaching and Learning: Digital Storytelling - https://www.coursera.org/learn/digital-storytelling
5. Presentation Skills: Speechwriting, Slides and Delivery Specialization - https://www.coursera.org/specializations/presentation-skills
6. Business English for Cross-Cultural Communication - https://www.coursera.org/learn/cross-cultural-communication-business

Reference Books:

1. Personal Development for Life and Work, Wallace and Masters, Thomson Learning
2. Organizational Behaviour, Robbins Stephens, Pearson Education
3. Me 2.0: 4 Steps to Building Your Future, Dan Schawbel, Diversion Books
4. Branding Pays: The Five-Step System to Reinvent Your Personal Brand, Karen Kang, Branding Pays Media
5. The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience, Carmine Gallo, McGraw Hill Education
6. Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds, Carmine Gallo, St. Martin's Press
7. The Storytelling Animal: How Stories Make Us Human, Jonathan Gottschall, Mariner Books
8. Made to Stick: Why Some Ideas Survive and Others Die, Chip Heath and Dan Heath, Random House
9. The Culture Map: Decoding How People Think, Lead, and Get Things Done Across Cultures, Erin Meyer, Public Affairs
10. Kiss, Bow, or Shake Hands: The Bestselling Guide to Doing Business in More Than 60 Countries, Terri Morrison and Wayne A. Conaway, Adams Media
11. Brand Thinking and Other Noble Pursuits, Debbie Millman,Allworth
12. Building a Brand Story: Clarify Your Message So Customers Will Listen, Donald Miller, HarperCollins

Course Name: Engineering Mathematics-V

Course Code: BS12

Category: Basic Science

Preamble:

The objective of the course is to impart knowledge of Probability, probability distribution Estimation theory, testing of hypothesis, Analysis of variance and Non parametric Test.

Pre-requisites:

Engineering Mathematics-I (BS01), Engineering Mathematics-II (BS03)

Course Objectives:

- Students will be able to collect, analyze, and interpret data using various descriptive statistical methods and understand the foundational principles of probability
- Students will be able to understand and apply the principles of sampling distributions and estimation techniques to infer population parameters from sample data and assess the reliability of these inferences.
- Students will be able to understand and apply the principles and procedures of hypothesis testing to make informed conclusions
- Students will be able to understand and apply the principles and techniques of Analysis of Variance (ANOVA) to compare multiple group means and assess the statistical significance of differences among them.

Course Outcome:

Learner will be able to:

CO1: interpret and work with discrete and continuous probability distributions including binomial, Poisson, normal, exponential, uniform, gamma, and beta distributions.

CO2: Analyze the difference between two sample means and proportions.

CO3: Construct confidence intervals for population means, the difference between two population means, population proportions, and the difference between two population proportions.

CO4: Formulate and conduct hypothesis tests for population means, the difference between two population means, population proportions, and the difference between two population proportions.

CO5: Conduct one-way and two-way ANOVA to analyze variance among groups.

CO6: Apply concepts of Non-parametric test to engineering problems

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	-	3	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No	Module name	Content	No of Hours
1	Descriptive statistics and probability	Basic probability and Baye's theorem, Discrete probability distributions, Continuous probability distributions Binomial, Poisson- and normal distributions, Exponential distribution, uniform distribution, gamma & beta distribution	8
2	Sampling Distributions	Sampling Distributions – small sample and large sample, sample mean, difference between two sample means, sample proportions, difference between two sample proportions.	8
3	Estimation	t- Distribution, Confidence intervals for - population mean, difference between two population means, population proportion, difference between two population proportions,	7
4	Hypothesis Testing	Hypothesis testing for – Population mean, difference between two population means, population proportions, difference between two population proportions, Type – I and II error	7
5	Analysis of Variance	Completely randomized design, Randomized complete block design, Regression and Correlation, Simple linear regression, correlation model, correlation coefficient, multiple regression, multiple correlation, one way and two way anova	8
6	Non-parametric Test	Chi square distribution - Properties, Test of goodness of fit, independence and homogeneity	7
Total			**45**

Reference Books:

1. Fundamentals of mathematical statistics by S. C. Gupta and V. K. Kapoor, second edition, Sultan Chand Publisher
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Probability and statistics for engineers by J. Ravichandran, Wiley /india
4. Probability and Statistics by Schaum's series
5. Probability and Random Process by T. Veerajan

Course Name: Automata Theory

Course Code: IT09

Category: Core

Preamble:
Automata theory (also known as Theory of Computation) is a theoretical branch of Computer Science and Mathematics, which mainly deals with the logic of computation with respect to simple machines, referred to as automata.

Pre-requisites:
Engineering Mathematics-III (BS05)

Course Objectives:

- To formalize mathematical models of computation: basic machines, deterministic and non deterministic machines and pushdown machines and Turing Machines.
- To learn fundamentals of formal grammars and languages.
- Develop understanding of different types of Turing machines, their use, capabilities & limitations.
- Understand the concept of Undecidability

Course Outcomes:
Learner will be able to:
CO1: Explain, analyze and design Regular languages, Expression and Grammars.

CO2: Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.

CO3: Analyze and design Context Free languages and Grammars.

CO4: Design different types of Push down Automata as Simple Parser.

CO5: Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.

CO6: Understand the concept of Undecidability

Course Scheme:

Contact Hours		Credits Assigned
Theory	Tutorial	Theory + Tutorial
2	1	3

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	40	20	40	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the

course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Finite Automata	DFA, NFA , NFA with and without ε , RE to NFA, NFA to DFA, Reduced DFA , NFA-DFA equivalence, Finite State Machines with output : Moore and Mealy machines. Moore and Mealy M/C conversion.	08
2	Regular Languages	Alphabets and Strings. Regular Languages: Regular Expressions, Regular Languages, Regular Grammars, RL and LL grammars, Closure properties	04
3	Context Free Grammars and Languages	CFG, Leftmost, Rightmost derivations, Ambiguity in grammars and languages. Simplification of Context Free Grammars, Chomsky normal form (CNF), Greibach normal form (GNF), Pumping Lemma for Context Free Languages.	08
4	Push Down Automata	Deterministic (single stack) PDA, Equivalence between PDA and CFG. Power and Limitations of PDA, examples of PDA.	04
5	Turing Machine	Deterministic TM, Variants of TM, Halting problem, Power of TM.	04
6	Undecidability and Recursively enumerable languages	Recursive and Recursively enumerable languages, Context-Sensitive Languages and the Chomsky Hierarchy. Unsolvable Problems: Halting Problem, Post's Correspondence Problem (PCP)	02
Total			**30**

Text Books:

1. Kavi Mahesh, "Theory of Computation A Problem Solving Approach", Wiley India
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
3. J.C.Martin, "Introduction to languages and the Theory of Computation", TMH.

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory,
2. Languages and Computation", Pearson Education
3. Daniel I.A. Cohen, "Introduction to Computer Theory", John Wiley & Sons
4. Michael Sipser, "Theory of Computation", Cengage Learning

Suggested Tutorial Plan

1. Tutorial on Finite State Machine, DFA, NFA
2. Tutorial on Mealy and Moore Machine.
3. Tutorial on Regular Expression
4. Tutorial on Grammar
5. Tutorial on Push down Automata
6. Tutorial on Turing Machine
7. Tutorial on Undecidability

Course Name: Data Warehousing & Mining

Course Code: IT10T

Category: Core

Preamble:
In today's data-driven world, organizations rely heavily on data warehousing and data mining techniques to extract meaningful insights from large volumes of data. This course aims to provide learners with a comprehensive understanding of the foundational principles of data warehousing and basic concepts of data mining. Through theoretical exploration, participants will gain insights into the design, implementation, and administration of data warehouses, as well as the fundamental techniques and applications of data mining.

Pre-requisites:
Database Management Systems (IT07T)

Course Objectives :

- Understand the fundamental concepts and historical development of data warehousing.
- Gain insights into the design principles and architecture of data warehouses.
- Explore the processes involved in ETL (Extract, Transform, Load) in data warehousing.
- Understand the fundamental concepts and architecture of data lakes as centralized repositories for storing and processing diverse data types.
- Familiarize oneself with basic concepts and techniques of data mining, including preprocessing, model building, and evaluation.
- Explore the various methods and applications of data mining in real-world scenarios.

Course Outcomes:
On successful completion, of course, learner/student will be able to:

CO1: Demonstrate a comprehensive understanding of the fundamental concepts of data warehousing and its architecture.

CO2: Design a data warehouse schema using dimensional modeling techniques and explain the ETL process involved in data warehousing.

CO3: To introduce concepts and fundamentals of data lakes

CO4: Understand data mining principles and perform data preprocessing and Visualization.

CO5: Understand the concept of data mining and identify appropriate data mining algorithms to solve real-world problems.

CO6: Implement basic data mining algorithms such as classification, clustering, and association mining

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to data warehouse and ETL Process	Introduction to Data Warehouse and Data Mart , Data warehouse architecture, Data warehouse vs Data Marts Dimensional modeling, Design of information package, star schema, snowflake schema, fact constellation schema, factless fact tables, aggregate fact tables. OLAP operations ETL process: Basic steps of the ETL process, different extraction methods, transformations, and different loading techniques.	8
2	Introduction to Data Lakes	Definition, key attributes of data lake, challenges, functionalities, architecture, Curating data lakes, Data Lake vs. data warehouse	3
3	Data Exploration and Data Preprocessing	The KDD process, Data mining system architecture, Data Exploration: Types of Attributes, Statistical Description of Data,Data Visualization: box plots, line & bar charts, and scatter plots.Data Preprocessing: Descriptive data, summarization, Cleaning, Integration & transformation, Data reduction.	5
4	Classification	Introduction to data mining techniques, Classification: Decision Tree Induction, Naïve Bayesian Classification. Regression: Simple and multiple	5
5	Clustering	Clustering: Partition based: K-means, Hierarchical Methods (Agglomerative, Divisive).	4
6	Mining frequent patterns and associations	Basic Concepts: Market Basket Analysis, Frequent Itemset, Closed Itemset, and Association Rules; Frequent Itemset. Mining Methods: The Apriori Algorithm: Finding Frequent Itemset Using Candidate Generation, Generating Association Rules from requent Itemset, Improving the Efficiency of Apriori, A pattern growth approach for mining Frequent Itemset, Mining Frequent Itemset using vertical data formats.	5
Total			**30**

Textbooks:

1. Margy Ross and Ralph Kimball, "The Data Warehouse Toolkit", 3rd edition, Willey
2. Paulraj Ponniah, "Data Warehouse Fundamentals", Wiley-Interscience Publication
3. Bill Inmon, "Data Lake Architecture", 1st edition, Technics Publication
4. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", 3rd edition, Elsevier

Reference Books:

1. W. H. Inmon, "Building the Data Warehouse", 3rd edition, Wiley Computer Publishing

Course Name: Data Warehousing & Mining Lab

Course Code: IT10P

Category: Core

Preamble:
In today's data-driven world, organizations rely heavily on data warehousing and data mining techniques to extract meaningful insights from large volumes of data. This course aims to provide learners with a comprehensive understanding of the foundational principles of data warehousing and basic concepts of data mining. Through hands-on exploration, learners will gain insights into the design, and implementation of data warehouses, as well as the fundamental techniques and applications of data mining.

Pre-requisites:
Database Management Systems Lab (IT07P)

Course Objectives:
- Understand and design the concepts of star, snowflake, and galaxy schemas for efficient data organization in data warehouses.
- Understand and execute complex queries, and apply OLAP operations effectively.
- Understand various preprocessing and visualization techinique.
- Apply regression techniques and classification algorithms to analyze data, predict outcomes, and gain valuable insights.
- Implement clustering algorithms to effectively group data based on similarities, facilitating improved data organization and analysis.
- Apply association rule mining techniques to identify and analyze patterns and relationships between variables in large datasets.

Course Outcomes:
Learner will be able to:
CO1: Develop and design star, snowflake, and galaxy schemas for data warehouses.
CO2: Execute complex queries and perform Online Analytical Processing (OLAP) operations to analyze data.
CO3 : Apply various data preprocessing and visualization techniques to effectively communicate data insights and patterns.
CO4: Implement regression techniques and classification algorithms to analyze data, predict outcomes, and gain valuable insights in practical scenarios.
CO5: Implement clustering algorithms to group data based on similarities.
CO6: Implement association rule mining techniques to identify and analyze patterns and relationships

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested list of experiments:

Sr. No.	List of experiments	Concept
1	Design Information Package, Star Schema & Snowflake Schema	Data Warehouse schema design
2	DW queries & OLAP operations	OLAP
3	Apply different visualization techniques	Data Visualization
4	To implement linear regression (Simple & Multiple) - Python	Regression analysis
5	To implement the ID3 decision tree algorithm – rapid miner and Weka	Classification
6	To implement Naïve Bayes classifier(python)	Classification
8	To implement the K-means clustering algorithm – weka and Rapidminer	Clustering
9	To implement Agglomerative clustering algorithm - python	Clustering
10	To implement the Apriori algorithm – Weka and RapidMiner	Association Analysis

Course Name: Advanced Data Structures and Algorithms

Course Code: IT11T

Category: Core

Preamble:

The course covers the fundamental principles and techniques used in designing and analyzing algorithms. Students will learn how to analyze the performance of algorithms, measure their efficiency, and compare different algorithms based on their time and space complexity. The course is designed for students with a solid understanding of programming and data structures. By the end of the course, students will have a deep understanding of the principles of algorithm design and analysis and will be equipped with the tools and techniques necessary to develop efficient algorithms for a wide range of computational problems.

Pre-requisites:

1. Engineering Mathematics-III (BS05)
2. Data Structures and Analysis (IT01T)

Course Objectives:

- To provide a deep understanding of algorithmic design and analysis techniques that enable the development of efficient and effective algorithms for solving computational problems.
- To develop a strong foundation in the theory of algorithms, including concepts such as time and space complexity, algorithmic paradigms, data structures, graph algorithms, sorting and searching, and dynamic programming.
- To equip students with the tools and techniques necessary to compare and evaluate the performance of different algorithms and choose the best algorithm for a given problem.
- To provide students with the knowledge and skills required for a successful career in software development, data analysis, and other fields that require strong analytical and problem-solving abilities.

Course Outcomes:

Learner will be able to:
CO1: Analyze the time and space complexity of algorithms.
CO2: Apply and Analyze Divide and Conquer strategy to solve given problems. CO3: Apply and Analyze Greedy strategy to solve given problems.
CO3: Apply and Analyze Dynamic Programming strategy to solve given problems.
CO4: Apply and Analyze Backtracking, Branch and Bound strategy to find solution for the given problems.
CO5: Classify a problem as computationally tractable or intractable and discuss strategies to address intractability.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Algorithm Analysis	Performance analysis: Space, and Time complexity, Growth of function. Asymptotic Notations: Big-Oh, Omega Theta notation. Analysis of selection sort, insertion sort and Naïve String-Matching Algorithm. Recurrences: The substitution method, Recursion tree method, Master method.	8
2	Divide and Conquer Approach	General method, Analysis of Merge sort and Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search.	4
3	Greedy Method Approach	General Method, Analysis of Minimum cost spanning trees: Kruskal and Prim's algorithm, Single source shortest path: Analysis of Dijkstra's Algorithm, Fractional Knapsack Problem and Job Sequencing with Deadlines	6
4	Dynamic Programming Approach	General Method, Finding nth term in Fibonacci series, Single Source Shortest Path: Bellman Ford Algorithm All Pair Shortest Path: Floyd Warshall's Algorithm, Longest Common Subsequence,0/1 Knapsack Problem, Matrix Chain Multiplication and Sum of Subset Problem.	7
5	Backtracking and Branch and Bound	General Method, Backtracking: N-queen problem, Graph Coloring. Branch and Bound: 15 Puzzle problem, Travelling Salesperson Problem	3
6	Introduction to Complexity Theory	The class P and NP. Polynomial reduction. NP-Complete Problems. NP-Hard Problems	2
Total			**30**

Text Books:

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005.
2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.

Course Name: Advanced Data Structures and Algorithms lab

Course Code: IT11P

Category: Core

Preamble:
The course covers the fundamental principles and techniques used in designing and analyzing algorithms. Students will learn how to analyze the performance of algorithms, measure their efficiency, and compare different algorithms based on their time and space complexity. The course is designed for students with a solid understanding of programming and data structures. By the end of the course, students will have a deep understanding of the principles of algorithm design and analysis and will be equipped with the tools and techniques necessary to develop efficient algorithms for a wide range of computational problems.

Pre-requisites:

- BS05 (Engineering Mathematics-III)
- CE01P (Data Structures Lab)

Course Objectives:

- To introduce the methods of designing and analyzing algorithms.
- Design and implement efficient algorithms for a specified application.
- Strengthen the ability to identify and apply suitable algorithms for the given real-world problem.
- Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.

Course Outcomes:

At the end of the course, the students will be able to
CO1: Implement the algorithms using different approaches. CO2:
Analyze the complexities of various algorithms.
CO3: Apply and Analyze Greedy strategy to solve given problems.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	--	25	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical's:

Sr No.	Suggested Topic(s)
1.	Introduction: Selection sort, Insertion sort
2.	Divide and Conquer Approach: Finding Minimum and Maximum, Merge sort, Quick sort, Binary search
3.	Greedy Method Approach: Single source shortest path- Dijkstra Fractional Knapsack problem Job sequencing with deadlines Minimum cost spanning trees-Kruskal and Prim's algorithm
4.	Dynamic Programming Approach: Single source shortest path- Bellman Ford All pair shortest path- Floyd Warshall 0/1 knapsack Longest common subsequence
5.	Backtracking: N-queen problem Graph coloring

Text Books:

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005.
2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.

Course Name: Software Engineering with WDL

Course Code: IT12T

Category: Core

Preamble:
To apply role of SDLC in Software Project Development with the concepts and features of Web Technology. Explore the agile methodologies that drive modern development, emphasizing collaboration and adaptability. The art and science of crafting dynamic, user-friendly websites and applications journey from foundational concepts to advanced techniques, gaining proficiency in HTML, CSS, JavaScript, and more. Through hands-on projects, you'll hone your skills, cultivating a portfolio showcasing your evolving expertise.

Pre-requisites:
NIL

Course Objectives:

- To provide knowledge of Software Engineering Discipline
- To Apply knowledge of Software Engineering Discipline for Web based applications
- To understand Requirement gathering process and design engineering
- To apply analysis and develop software solutions
- To demonstrate and evaluate real time projects with respect to web based software projects
- To apply and analyze testing and quality assurance in web based software solutions

Course Outcomes:

Learner will be able to:
CO1: Define various software application domains and remember different process model used in software development.

CO2: Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques.

CO3: Justify role of SDLC in Software Project Development and they can evaluate importance of Software Engineering in PLC.

CO4: Apply testing to assure quality in software solution and Identify risks, manage the change to assure quality in software projects.

CO5: Understand the core concepts and features of Web Technology

CO6: Design static web pages using HTML5 and CSS3

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Web Programming and Concepts	Introduction to HTML, HTML Document Structure Text Elements, Images and Attributes, Hyperlinks, Semantic HTML, complex image maps, tables and nested tables, Inserting web page, Setting & modifying field properties, Validating HTML CSS: Internal and External CSS, CSS Grid Overview, Sizing Grid Columns and Rows, Building a Simple CSS Grid Layout Javascript & Document Object Model: Introduction to JavaScript, Variables and Objects, Decision Making Statement, Loops, Arrays, Functions & Prototypes, Core JavaScript Objects, DOM Introduction, Event Model, Function	8
2	The Software Process	Generic view of Process, Prescriptive Models: Waterfall Model, Incremental-RAD Model, Evolutionary Process Model-Prototyping, Spiral Agile Methodology, Scrum and Extreme Programming	4
3	Requirements Engineering and Analysis	Requirement, Types of Requirements, Requirement Gathering , Requirement Engineering Task, SRS (Software Requirement Specification)	4
4	Software Estimation and Scheduling	Management Spectrum, 4Ps (people, product and process) ,Process and Project metrics, Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO Model, Project scheduling: WBS, Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule	5
5	Design Engineering	Software Design Concepts, Interaction Design , Design Golden Rules and Heuristics.	3

6	Software Testing and Risk Management	Testing: Software Quality, Testing: Strategic Approach, Strategic Issues- Testing: Strategies for Conventional Software. Risk Management: Risk Identification, Risk Assessment, Risk Projection, RMMM, Software Configuration management, SCM process- Version Control , Change Control	6
Total			**30**

Textbooks:

1. Software Engineering: A Practitioner's Approach Roger Pressman McGraw-Hill Publications
2. Software Engineering Ian Sommerville, Pearson Education (9th edition)
3. Software Engineering FundamentalsAli Behfrooz and Fredeick J.Hudson Oxford University Press
4. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services

-

Reference Books:

1. Software Engineering – Concepts and Practices, Ugrasen Suman, Cengage Learning
2. An integrated approach to Software Engineering, Pankaj Jalote,, Springer/ Narosa
3. Web Development with Node and Express, Ethan Brown, O'Reilly

Course Name: Software Engineering with WDL Lab

Course Code: IT12P

Category: Core

Preamble:

Integrate the principles of Software Development Life Cycle (SDLC) into the realm of Software Project Development, specifically aligning them with the dynamic landscape of Web Technology. Investigate contemporary agile methodologies that propel modern development practices, with a focus on fostering collaboration and adaptability. Embark on the captivating journey of mastering the craft of designing dynamic and user-friendly websites and applications, progressing from fundamental concepts to advanced techniques. Develop proficiency in essential technologies such as HTML, CSS, JavaScript, and beyond through practical, hands-on projects.

Pre-requisites:
NIL

Course Objectives:

- To Apply knowledge of Software Engineering Discipline for Web based applications
- To understand Requirement gathering process and design engineering
- To apply analysis and develop software solutions
- To demonstrate and evaluate real time projects with respect to web based software projects
- To apply and analyze testing and quality assurance in web based software solutions

Course Outcomes:

Learner will be able to:

CO1: Characterize diverse domains of software applications and recall various process models employed in software development.

CO2: Elaborate on the necessity of software specifications, categorize different types of software requirements, and articulate techniques for gathering them.

CO3: Validate the significance of the Software Development Life Cycle (SDLC) in Software Project Development.

CO4: Implement testing methodologies to ensure quality in software solutions. Identify and manage risks and changes to guarantee quality in software projects.

CO5: Comprehend the fundamental concepts and features of Web Technology.

CO6: Formulate static web pages using HTML5 and CSS3.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

Sr No.	Title of Practical
1	Project Selection and Conceptualization
2	Create Simple web page using HTML5
3	Design a web page using CSS (Cascading Style Sheets) which includes the following: Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles.
4	Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contain alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters in length). 3. E-mail id (should not contain any invalid characters and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5. Last Name and Address (should not be Empty).
5	Prepare SRS for the Project topic (Private study/Home work)
	Design database for the Project topic
6	Prepare DFD-Data flow diagram for the Project topic (Private study/Home work)
	Develop interactive web pages using PHP with database connectivity MYSQL for the Project topic
7	Prepare Use case diagram for the Project topic (Private study/Home work) Prepare Sequence Activity diagram for the Project topic (Private study/Home work)
	Develop interactive web pages using PHP with database connectivity MYSQL for the Project topic (Continued)
8	Prepare Component and Deployment diagram for the Project topic (Private study/Home work)
	Hosting the website with Domain Registration Process
9	Prepare WBS and Gantt Chart for the Project topic
10	Prepare Test Case plan for Project topic
11	Prepare RMMM Document for Project topic

Textbooks:

1. Software Engineering: A Practitioner's Approach, Roger Pressman, McGraw-Hill Publications
2. Software Engineering, Ian Sommerville, Pearson Education , (9th edition)
3. Software Engineering FundamentalsAli Behfrooz and Fredeick J.Hudson, Oxford University Press
4. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services

Reference Books:

1. Software Engineering – Concepts and Practices, Ugrasen Suman, Cengage Learning
2. An integrated approach to Software Engineering, Pankaj Jalote, Springer/ Narosa
3. Web Development with Node and Express, Ethan Brown, O'Reilly

Course Name: Artificial Intelligence

Course Code: IT21T

Category: PEC (AIML)

Preamble:
Intelligent machines have replaced human capabilities in many areas. Artificial intelligence is the intelligence exhibited by machines or software. It emphasizes on creating intelligent machines that work and react like humans.

Pre-requisites:
NIL

Course Objectives:

1. Understand Artificial Intelligence
2. Know and use various problem-solving methods
3. Acquire and use knowledge representation methods in AI
4. Understand and design Artificial intelligence Agents
5. Know and identify AI applications
6. Design and apply Artificial Intelligence in community

Course Outcomes:
Learner will be able to:

CO1: To understand the basics of Artificial Intelligence

CO2: To know and use various problem-solving methods

CO3: To acquire and use knowledge representation methods in AI

CO4: To understand and design Artificial intelligence Agent

CO5: To know and identify AI applications

CO6: To design and apply Artificial Intelligence in community

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Artificial Intelligence	• Artificial Intelligence Introduction, Intelligent systems • Categorization of Intelligent Systems • Characteristics of AI • Current Trends in AI	4
2	Intelligent Agents	• Agents and Environment, Structure of Agents, Types of agents, Learning agent, • Agent communication • Negotiation and Bargaining • Argumentation among Agents • Trust and Reputation in Multi-agent systems	5
3	Problem Solving Methods	• Uninformed search Breadth First Search, Depth First Search, Depth First iterative deepening, • Informed Search Greedy best first, A*, Heuristic search • Adversarial Search Game playing, alpha beta pruning, Min-Max search • Local search algorithms and optimization Hill climbing search, Genetic algorithms,	6
4	Knowledge Representation	• Knowledge Representation, brief overview of propositional logic, FOL syntax and semantic, forward chaining and backward chaining • Unification, resolution, • Uncertain knowledge and Engineering : knowledge in uncertain domain, semantics of belief network, simple inference in belief network	6

5	Planning and Learning	• Planning :Planning problem, Partial order planning, Hierarchical planning, Conditional planning • Learning : Forms of Learning, Theory of learning, PAC learning, Introduction to statistical learning	5
6	Artificial Intelligence Applications with Real Time USECASE	Students are supposed to study any AI Application and provide insights about the concepts used in respective application.	4
Total			**30**

Textbooks:

5. Artificial Intelligence: A Modern Approach (AIMA) is a university textbook on artificial intelligence, written by Stuart J. Russell and Peter Norvig.
6. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

Course Name: Artificial Intelligence Lab

Course Code: IT21P

Category: PCE (AIML)

Preamble: Intelligent machines have replaced human capabilities in many areas. Artificial intelligence is the intelligence exhibited by machines or software. It emphasizes on creating intelligent machines that work and react like humans. AI labs will help to understand these concepts with practical experiments.

Pre-requisites:
NIL

Course Objectives:

- Understand Artificial Intelligence
- Know and use various problem-solving methods
- Acquire and use knowledge representation methods in AI
- Understand and design Artificial intelligence Agents
- Know and identify AI applications
- Design and apply Artificial Intelligence in community

Course Outcomes:
Learner will be able to:

CO1: To understand and conceptualize basic ideas and techniques in artificial Intelligence

CO2: To know and use various problem-solving methods

CO3: To acquire and choose appropriate knowledge representation methods in AI

CO4: To understand and design Artificial intelligence Agents

CO5: To know and identify AI applications

CO6: To design and develop Artificial Intelligence Applications in real world scenarios

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

Suggested List of Practicals:

Sr No.	Title of Practicals
1	One case study on AI applications published in IEEE/ACM/ Springer Journals
2	Program on uninformed search methods (BFS)
3	Program on uninformed search methods (DFS)
3	Program on informed search methods (A *)
4	Program on game playing assignments (Minmax)
5	Program on First order logic
6	Project (Develop any small AI Application)

Course Name: Advanced Database management System

Course Code: IT22T

Category: PEC (Data Analytics)

Preamble:

Mastering on mastering advanced database systems demands a structured approach. Our comprehensive roadmap covers query processing, advanced data management, distributed databases, big data, NoSQL, enhanced data models, and information retrieval. Each module delves into its domain, blending theory with hands-on tasks. This systematic curriculum ensures learners gain a holistic understanding of modern database systems, ready to navigate complex data landscapes.

Pre-requisites:
DBMS

Objective:

1. To impart knowledge related to query processing and query optimization phases of a database management system.
2. To learn advanced techniques for data management and to overview emerging data models like Temporal, Mobile, and Spatial database.
3. To introduce advanced database models like distributed databases.
4. To create awareness of how enterprise can organize and analyse large amounts of data by creating a Data Warehouse.
5. To understand the process of data extraction, transformation and loading. 6 To understand the concept of Big data and NoSQL databases.
6. To learn different IR models and queries in IR Systems

Course Outcomes:
Learner will be able to:

CO1: Measure query costs and design alternate efficient paths for query execution.

CO2: Apply sophisticated access protocols to control access to the database.

CO3: Design distributed databases for improving resource utilization, availability and performance

CO4: To apply the traits of temporal and spatial data models as per the need

CO5: Perform efficient and effective retrieval of information to facilitate the decision making

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	**Query Processing and Optimization**	Overview: Introduction, Query processing in DBMS, Steps of Query Processing, Measures of Query Cost Selection Operation, Sorting, Join Operation, Evaluation of Expressions. Query Optimization Overview, Goals of Query Optimization, Approaches of Query Optimization, Transformations of Relational Expression Estimating Statistics of Expression Results Choice of Evaluation Plans. Self-learning Topics: Solve problems on query Optimization	6
2	**Access Control Mechanism**	Discretionary Access Control Based on Granting and Revoking Privileges. Mandatory Access Control and Role Based Access Control, Remote Database access protocol. Self-learning Topics: Learn Data Security concepts like Authentication, Authorization and encryption.	6
3	**Distributed Databases**	Introduction: Distributed Data Processing, Distributed Database System: Architecture, Types, Design Issues. Data Fragmentation, Allocation in distributed databases.	6

		Self-learning Topics: Query Optimization in Distributed Databases	
4	**Enhanced Data Models**	Active Database Concepts and Triggers, Temporal Database, Spatial Database, Introduction to Deductive Databases Self-learning Topics: Case Study like : "Temporal Dynamics in Information Retrieval: Modelling Temporal Relevance and Query Intent Shifts Over Time"	6
5	**Introduction to Information Retrieval**	Retrieval Models, Types of Queries in IR Systems, Text Preprocessing Self-learning Topics : Case Study like “Information retrieval evaluation in practice”	6
Total			**30**

Textbooks:

[1]. Korth, Slberchatz,Sudarshan, :”Database System Concepts”, 6th Edition, McGraw – Hill
[2]. Elmasri and Navathe, “Fundamentals of Database Systems”, 6th Edition, PEARSON Education.
[3]. Theraja Reema, “Data Warehousing”, Oxford University Press.
[4]. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems” 3rd Edition -
McGraw Hill

References:

[1] Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals”, Wiley India.
[2] Ralph Kimball, Margy Ross, “The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling”, 3rd Edition. Wiley India.
[3] Peter Rob and Carlos Coronel, “Database Systems Design, Implementation and Management”, Thomson Learning, 9th Edition

Course Name: Advanced database Lab

Course Code: IT17P

Category: PEC (Data Analytics

Preamble:

The Advanced Database Laboratory immerses students in leading-edge database technologies and advanced concepts, expanding upon foundational knowledge from prerequisite courses. Through hands-on exploration, students delve into topics including NoSQL databases, distributed data management, query processing and optimization, and advanced SQL techniques. Practical exercises and projects facilitate a deeper understanding of database design, optimization, and administration. Additionally, students gain valuable insights into emerging trends and challenges within the dynamic realm of database management.

Pre-requisites:

DBMS

Objective:

- Mastering Conceptual DB Design using EER Model and implementing it using SQL DDL
- Explore advanced SQL concepts
- Gain practical experience in working with distributed databases, temporal data bases, spatial data bases and active databases and proposing a solution using appropriate model(s).
- Learn how to integrate PHP scripts with MySQL databases to create dynamic web applications.
- Develop proficiency in designing, implementing, and optimizing complex database systems for real-world applications and interface a database with front end tools
- Apply best practices in database administration, security, and scalability to ensure robust and efficient database systems.

Course Outcomes:

Learner will be able to:

CO1: Students will be able to design database schemas using EER model techniques and implement them using SQL.

CO2: Students will demonstrate proficiency in writing advanced SQL queries and understand query optimization principles.

CO3: Students will develop skills in accessing and manipulating databases through JDBC in Java programs.

CO4: Students will understand query evaluation plans, indexing strategies, and their impact on database performance.

CO5: Students will implement distributed database solutions, including partitioning strategies, for scalability and performance.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

Suggested list of experiments:

Sr. No.	List of experiments
1	Design EER Model for a real-life scenario and implement it using SQL
2	Understand and compare performance by rewriting queries using indexing
3	Implement the Program to estimate cost of the query for various join operation
4	Build Web Applications with access control features
5	Explore the security and access control features of PostgreSQL (or equivalent system)
6	Implementation of fragmentation in distributed database environment.
7	Implementation of triggers for understanding features of active database
8	Design a temporal and spatial data base schema , map it to tables and solve queries involving temporal and spatial attributes

Textbooks:

[1]. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 4th Edition, Pearson/Addision wesley, 2007

[2]. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 6th edition, Tata McGraw Hill, 2011

Reference Books:

[1] T. Özsu and P. Valduriez, Distributed Database Systems. Prentice Hall, Oct. 2011. [ISBN: 013616736X]

[2]. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Martin Fowler and Pramod J. Sadalage

Course Name: Modern Sensors for Internet of Things

Course Code: IT23T

Category: PEC (IoT)

Preamble:

This course introduces students to the fundamental principles and applications of sensors in various engineering fields. It covers different types of sensors, their working mechanisms, and their integration into systems, including IoT, embedded systems, and other fields.

Pre-requisites: Nil

Course Objectives:

- Understand the basic principles and classifications of sensors.
- Learn about various types of sensors and their applications.
- Design and implement sensor systems in practical scenarios.
- Integrate sensors with IoT and embedded systems.
- Explore the use of sensors in biomedical applications

Course Outcomes:

Student will be able to:

CO1: Understand fundamentals of Sensors and their characteristics.

CO2: Use different type sensors in Embedded and IoT applications.

CO3: Apply knowledge of conditioning in the design of data acquisition system.

CO4: Create a small sensor network using knowledge of communication protocols.

CO5: Understand concept of communication protocols.

CO6: Designing small application using one or more sensor.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head	ISA	MSA	ESA	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Sensors Fundamentals and Characteristics	Sensor Classification, Physical Principles of Sensors- Resistive, capacitive, inductive sensors, Optical, magnetic, and thermal sensors, Sensor Characteristics, Performance and Types, Error Analysis characteristics- Sensitivity, accuracy, precision, range, and resolution. Response time and stability, Applications in various fields and criteria to select sensor	5
2	Types of sensors	Optical Sensors- Photodetectors and phototransistors, Fiber optic sensors, Imaging sensors. Mechanical Sensors- Strain gauges and pressure sensors, Accelerometers and gyroscopes, Ultrasonic sensors. Chemical and Biological Sensors- Electrochemical sensors, gas sensors, humidity and temperature sensors, Biosensors	6
3	Data acquisition and Signal Conditioning	Analog and Digital data acquisition system, Data logger, Amplification, filtering, and Analog-to-Digital conversion, Noise reduction techniques, Calibration methods	5
4	Wireless Sensor Networks	Basics of wireless communication, Network topologies and protocols, Bluetooth, ZigBee, Ultra Wide Band (UWB), Near Field Communication (NF) and RFID, WiFi and IEEE 802.11architecture, applications in IoT.	6
5	IoT Systems Integration and communication protocols	Introduction to IoT, Integrating sensors with microcontrollers (e.g., Arduino, Raspberry Pi), Communication protocols (I2C, SPI, UART),	4
6	Sensor applications	On board automobile sensing system, Home automation and Environment monitoring system, Biomedical sensing system, Radio sensing for industrial applications,	4
Total			**30**

Textbooks:

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland
3. D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003
4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
5. Sensors and Transducers" by Ian R. Sinclair - Comprehensive introduction to various sensors and their applications.

Reference Books:

1. Edited by Qusay F Hasan, Atta ur rehman Khan, Sajid A madani, "Internet of Things Challenges, Advances, and Application", CRC Press
2. Triethy HL - Transducers in Electronic and Mechanical Designs, Mercel Dekker, 2003
3. Gerd Keiser,"Optical Fiber Communications", 2017, 5th edition, McGraw-Hill Science, Delhi. 212
4. John G Webster, Halit Eren, "Measurement, Instrumentation and sensor Handbook", 2014, 2nd edition, CRC Press, Taylor and Fransis Group, New York.
5. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
6. Nathan Ida, "Sensors, Actuators and their Interfaces: A Multidisciplinary Introduction", Second Edition, IET Control, Robotics and Sensors Series 127, 2020

Course Name: Modern Sensors for Internet of Things Lab

Course Code: IT23P

Category: PEC (IoT)

Preamble:

This course introduces students to different types of sensors, their working mechanisms, and their integration into systems. Selection and interfacing of a sensor in the IoT and embedded systems design.

Pre-requisites: Nil

Course Objectives:

- To understand various sensors type and their characteristics.
- To understand different type of sensors and their application.
- To understand communication protocol and their use in sensor network.
- To understand various types communication protocols required in IoT applications and their characteristics.
- To learn to develop small IoT or Embedded system using sensor.

Course Outcomes:

Student will be able to:

CO1: Identify and test the characteristics of various sensors.

CO2: Select most appropriate sensor and design required signal condition for the same.

CO3: Implement communication and wireless communication protocol in IoT application.

CO4: Design and implement small IoT or Embedded system.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Scheme:

Head	ISA	MSA	ESA	Total
Practical	25	-	25	050

Suggested List of Practical:

- Identification of sensor and their important characteristics.
- Testing and Calibration of sensor.
- Identification of Sensitivity, range, resolution, Response time parameters of sensors
- Develop a system to record one of the physical parameter using appropriate sensor
- Develop a system to communicate one or more physical parameters using wireless communication.
- Develop a system to communicate one or more physical parameters using communication protocol.
- Design and develop a small IoT or system using one or more sensor and a communication procol.

Textbooks:

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland
3. D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003
4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
5. Sensors and Transducers" by Ian R. Sinclair - Comprehensive introduction to various sensors and their applications.

Reference Books:

1. Edited by Qusay F Hasan, Atta ur rehman Khan, Sajid A madani, "Internet of Things Challenges, Advances, and Application", CRC Press
2. Triethy HL - Transducers in Electronic and Mechanical Designs, Mercel Dekker, 2003
3. Gerd Keiser,"Optical Fiber Communications", 2017, 5th edition, McGraw-Hill Science, Delhi. 212
4. John G Webster, Halit Eren, "Measurement, Instrumentation and sensor Handbook", 2014, 2nd edition, CRC Press, Taylor and Fransis Group, New York.
5. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
6. Nathan Ida, "Sensors, Actuators and their Interfaces: A Multidisciplinary Introduction", Second Edition, IET Control, Robotics and Sensors Series 127, 2020

Course Name: Computer & Network Security

Course Code: IT24T

Category: PEC (Cyber Security)

Preamble:
Most today's computing devices support network connectivity, from your laptops and desktops to web servers, to Internet-of-Things devices. This connectivity is essential for enhancing the capabilities of computer technology. However, it has also fostered an environment rampant with network security and privacy concerns. This course aims to provide a thorough grounding in network security suitable for those interested in working in or conducting research in the area, as well as students more generally interested in either security or networking. We will examine core network protocols and their security, as well as broader issues relating to Internet security for which networking plays a role. Through this course, you should learn the fundamentals of how computer networks should operate, and what can and does go wrong.

Pre-requisites:
Computer Networks- IT06T, Operating system- IT05T

Course Objectives:
- Basic concepts computer networks and security
- Various cryptography algorithms including secret key management and different authentication techniques.
- Different types of malicious software's and its effect on security
- Various secure communication standards including IPSEC, SSL/TLS and email.
- Network management security and network access control techniques in computer security.
- Different attacks on network and infer the use of firewalls and security protocol.

Course Outcomes:
Learner will be able to:

CO1: Explain the fundamentals concepts of computer security and network security.

CO2: Identify the basic cryptographic techniques using classical and block encryption methods.

CO3: Study and describe the system security malicious software.

CO4: Describe the Network layer security, Transport layer security and application layer security.

CO5: Explain the need of network management security and illustrate the need for NAC.

CO6: Identify the function of an IDS and firewall for system security.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Network Security & cryptography	Computer security and Network Security(Definition), CIA, Services, Mechanisms and attacks, The OSI security architecture, Network security model. Classical Encryption techniques (mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher, transposition techniques: keyed and keyless transposition ciphers). Introduction to steganography	4
2	Cryptography: Key management, distribution and user authentication	Cryptography: Key management, distribution and user authentication Block cipher modes of operation, Data Encryption Standard, Advanced Encryption Standard (AES). RC5 algorithm. Public key cryptography: RSA algorithm. Hashing Techniques: SHA256, SHA-512, HMAC and CMAC, Digital Signature Schemes – RSA, DSS. Remote user Authentication Protocols, Kerberos, Digital Certificate: X.509, PKI	8
3	Malicious Software	Malicious Software: SPAM, Trojan horse, Viruses, Worms, System Corruption, Attack Agents, Information Theft, Trapdoor, Keyloggers, Phishing, Backdoors, Rootkits, Denial of Service Attacks, Zombie	4
4	IP Security	IP Security, Transport level security and Email Security: IP level Security: Introduction to IPSec, IPSec Architecture, Protection Mechanism (AH and ESP), Transport level security: VPN. Need Web Security considerations, Secure Sockets Layer (SSL)Architecture, Transport Layer Security (TLS), HTTPS,	8

		Secure Shell (SSH) Protocol Stack. Email Security: Secure Email S/MIME Screen reader support enabled.	
5	Network Management Security and Network Access Control	Network Management Security and Network Access Control: Network Management Security:SNMPv3, NAC: Principle elements of NAC, Principle NAC enforcement methods, How to implement NAC Solutions, Use cases for network access control	4
6	System Security	System Security: IDS, Firewall Design Principles, Characteristics of Firewalls, Types of Firewalls	2
Total			**30**

Textbooks:

1. Cryptography and Network Security: Principles and Practice by William Stallings, 6th edition Pearson publication
2. Cryptography and Network security by Behrouz A. Forouzan, Tata Mc Graw Hill
3. Information Security Principles and Practice, Mark Stamp, Wiley publication

Reference Books:

1. Security in Computing by Charles P. Pfleeger, Pearson publication
2. Computer Security Art and Science by Matt Bishop, Addison- Wesley publication

Course Name: Computer & Network Security Lab

Course Code: IT24P

Category: PEC (Cyber Security)

Preamble:
The purpose of this security lab is to provide hands-on experience and practical knowledge in understanding various aspects of cybersecurity and information security practices. Through this lab, students will explore different security mechanisms, tools, techniques, and methodologies to safeguard digital assets, mitigate risks, and respond effectively to security incidents. Security lab provides a valuable opportunity for participants to gain practical skills, insights, and hands-on experience in the field of cybersecurity. By actively engaging in lab activities and embracing security best practices, students will be better equipped to address the evolving challenges and complexities of today's cybersecurity landscape.

Pre-requisites:
Computer Networks- IT06T, Operating system- IT05T

Course Objectives:
- To apply the knowledge of symmetric cryptography to implement classical ciphers
- To analyze and implement public key encryption algorithms, hashing and digital signature algorithms
- To explore the different network reconnaissance tools to gather information about networks
- To explore the tools like sniffers, port scanners and other related tools for analyzing
- To Scan the network for vulnerabilities and simulate attacks
- To set up intrusion detection systems using open source technologies and to explore email security

Course Outcomes:

Learner will be able to:

LO1: Illustrate symmetric cryptography by implementing classical ciphers.

LO2: Demonstrate Key management, distribution and user authentication.

LO3: Explore the different network reconnaissance tools to gather information about networks.

LO4: Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.

LO5: Use open-source tools to scan the network for vulnerabilities and simulate attacks

LO6: Demonstrate the network security system using open-source tools.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr No.	Title of Practicals
1	Classical Encryption techniques (mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher)
2	1)Block cipher modes of operation using a) Data Encryption Standard b)Advanced Encryption Standard (AES). 2)Public key cryptography: RSA algorithm. 3)Hashing Techniques: HMAC using SHA 4)Digital Signature Schemes – RSA, DSS
3	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
4	1) Download and install nmap. 2) Use it with different options to scan open ports, perform OS fingerprinting, ping scan, tcp port scan, udp port scan, etc.
5	a) Keylogger attack using a keylogger tool. b) Simulate DOS attack using Hping or other tools c) Use the NESSUS/ISO Kali Linux tool to scan the network for vulnerabilities
6	1) Set up IPSec under Linux. 2) Set up Snort and study the logs. 3) Explore the GPG tool to implement email security
7	Design a network and demonstrate. 1) Path the network follows before implementing VPN 2) Path the network follows after implementing VPN
8	Demonstrate Phishing attack over LAN and WAN network using Kali Linux
9	Demonstrate SQL Injection attack using Kali Linux
10	Demonstrate Fake Email attack using Kali Linux

Textbooks:

1. Build your own Security Lab, Michael Gregg, Wiley India.
2. CCNA Security, Study Guide, TIm Boyles, Sybex.

3. Hands-On Information Security Lab Manual, 4th edition, Andrew Green, Michael Whitman, Herbert Mattord.
4. The Network Security Test Lab: A Step-by-Step Guide Kindle Edition, Michael Gregg.

Reference Books:

1. Network Security Bible, Eric Cole, Wiley India.
2. Network Defense and Countermeasures, William (Chuck) Easttom.
3. Principles of Information Security + Hands-on Information Security Lab Manual, 4th Ed. , Michael Whitman , Herbert J. Mattord.

Course Name: Minor Project-I

Course Code: IT46

Category: Project and Internship

Preamble:

The primary objective of the Minor Project is to provide students with a platform to explore, analyze, and implement their understanding of Web development, Data Mining, Data Analytics and Internet of things (IoT). This practical endeavour aims to enhance critical thinking, problem-solving skills, and project management capabilities. Students will delve into real-world challenges, applying concepts learned in the classroom to develop creative and effective solutions.

Pre-requisites: NA

Course Objectives:
1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcomes:

Learner will be able to:

CO1: Identify problems based on societal /research needs and apply Knowledge and skill to solve societal problems in a group.

CO2: Develop interpersonal skills to work as member of a group or leader and Excel in written and oral communication.

CO3: Draw the proper inferences from available results through theoretical/ experimental/simulations and analyze the impact of solutions in societal and environmental context for sustainable development.

CO4: Use standard norms of engineering practices

CO5: Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.

CO6: Demonstrate project management principles during project work.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	4	-	2

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25		50	75

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall decide her/his assessment methodology based on the course's nature. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Guidelines for Mini Project:

1. Students shall form a group of 3 to 4 students.
2. Students can select their project work in one or more of the following mentioned areas/domains:
    1. Web development
    2. Data Mining
    3. Data Analytics
    4. Internet of things (IoT)
3. Students should do survey and identify needs, which shall be converted into problem statement for minor project in consultation with faculty supervisor/head of department/internal committee of faculties.
4. Students have to submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of minor project.
5. A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
6. Faculty supervisor may give inputs to students during minor project activity; however, focus shall be on self-learning.
7. Students in a group shall understand problem effectively, propose multiple solutions and select best possible solution in consultation with guide/ supervisor.
8. Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
9. The solution to be validated with proper justification and report to be compiled in standard format provided by the department.
10. With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students.
11. However, based on the individual students or group capability, with the mentor’s recommendations, if the proposed Minor Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Minor Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case-by-case basis.

Internal Assessment:

- The review/ progress monitoring committee shall be constituted by head of department. The progress of mini project to be evaluated on continuous basis, minimum two reviews during the semester.
    1. Review 1: First review shall be for finalisation of problem and proposed solution
    2. Review 2: Second review shall be for implementation and testing of solution.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of internal assessment marks for minor project shall be as below:

1. Marks awarded by guide/supervisor based on log book: 10
2. Marks awarded by review committee: 10
3. Quality of Project report: 05

Minor Project shall be assessed based on following criteria:

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness and Societal impact
6. Full functioning of working model as per stated requirements
7. Effective use of skill sets
8. Effective use of standard engineering norms
9. Contribution of an individual's as member or leader
10. Clarity in written and oral communication

In case of minor project-I all criteria in generic may be considered for evaluation of performance of students in mini project.

End semester examination assessment:

- Report should be prepared as per the guidelines issued by the department.
- Minor Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.