



Shri Shamrao Patil (Yadavkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

NBA Accredited, Accredited by NAAC 'A' Grade, ISO 9001:2015 Certified

Department: Computer Science Engineering

Rev: Course Structure/01/NEP/2023-24

Class: T.Y. B. Tech.

Semester: V

Sr No	Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
1	23CS3501	PCC	Advanced Java Programming	3		-	3	10	10	30	50	100	3
2	23CS3502	PCC	Design Analysis and Algorithms	3	-	-	3	10	10	30	50	100	3
3	23CS3503	PCC	Advanced Database Engineering	3	-	-	3	10	10	30	50	100	3
4	23CS3504	PCC	Advanced Java Programming Laboratory	-	-	2	2	15	15	-	20	50	1
5	23CS3505	PCC	Design Analysis and Algorithms Laboratory	-	-	2	2	15	15	-	20	50	1
6	23CS3506	PCC	Advanced Database Engineering Laboratory	-	-	2	2	15	15	-	20	50	1
7	23CS3507	PEC	Program Elective Course-I	3	-	-	3	10	10	30	50	100	3
8	23CS3508	CEP	Mini Project – III	-	-	2	2	25	25	-	-	50	1
9	23CSMDXX	MDM	Multidisciplinary Minor-III	3	-	-	3	10	10	30	50	100	3
10	23OECS31	OE	Open Elective III	3	-	-	3	10	10	30	50	100	3
11	23HSSM05	VEC	Aptitude Skills-III	1	-	-	1	25	25	-	-	50	Audit
12	23HSSM06	VEC	Language Skills-III	-	-	2	2	25	25	-	-	50	Audit
Total				19	-	10	29	180	180	180	360	900	22

*Open Elective III: Object Oriented Modeling and Design

Note- Open Elective course will be offered to students of other programs and will not be offered to students of the same program.

Multidisciplinary Minor-III

Basket	Agriculture	Management	Healthcare
Course Code, Name	Data Science for Agriculture (23CSMDA3)	Innovation, Business Models and Entrepreneurship (23CSMDB3)	Telemedicine and Remote Patient Monitoring (23CSMDC3)

Program Elective Courses-I - 23CS3507A) Text and Speech Analysis
23CS3507B) Cloud Computing
23CS3507C) Cryptography
23CS3507D) Introduction to AI



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23CS3501	PCC	Advanced Java Programming	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Java Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a GUI application using swing components.
CO2	Explain event-driven programming concepts by using appropriate event classes, listener interfaces.
CO3	Construct applications that interact with relational databases using JDBC for data connectivity, manipulation, and retrieval.
CO4	Take part in Servlets with HTML forms and databases for dynamic content generation.
CO5	Make use of Java Server pages to implement dynamic web pages.
CO6	Design database-driven applications using Hibernate ORM framework by applying concepts of object-relational mapping, annotations.

Course Contents:

Unit 1: Swings Introduction to JFC and Swing, Difference between AWT and Swing, Features of the Java Foundation Classes, Swing Components: Swing Classes Hierarchy, Commonly used Methods of Component class (add(), setSize(), setLayout(), and setVisible()), JApplet, JFrame, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JComboBox, JMenu, Advanced Swing Components(JTabbedPane, JScrollPane, JTree, JTable, JProgressBar, JSlider, JDialog) Layout Management: Flow Layout, Border Layout, Card Layout, Box Layout, Grid Layout, Gridbag Layout.	[6]
Unit 2: Event Handling Event Handling: Introduction, Action Events, Key Events, Focus Events, Window Event, Mouse Event, Item Events, TextEvent, EventListenerInterface: ActionListener, KeyListener, FocusListener, WindowListener, MouseListener, MouseMotionListener, ItemListener, Event Handling using Adapter Classes.	[6]





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Unit 3: JDBC Programming Two-Tier Database Design, Three-Tier Database Design, JDBC- advantages and disadvantages, JDBC drivers, The JDBC API: The API components, Steps to Establish JDBC Connection (DriverManager, Connection, Statement), database operations like, CRUD (Create, Read, Update, Delete) operations using SQL Queries using Statement and PreparedStatement, Retrieving Data using ResultSet, develop java program using JDBC.	[6]
Unit 4: Servlet API and Overview Introduction to servlet, The life cycle of a servlet, Developing and deploying servlets, ServletRequest, ServletResponse Interfaces, Handling HTTP methods (GET, POST), Servlet config and Servlet context, Session Management using Cookies and HttpSession.	[6]
Unit 5: Java Server Pages Introduction to JSP: problem with Servlet, lifecycle of JSP, JSP Scripting elements (Scriptlets, Expressions, Declarations), JSP Directives (page, include, taglib), JSP Actions (Standard Actions), Implicit objects in JSP, Custom tags, Integrating JSP with Servlets.	[6]
Unit 6: Hibernate Introduction to hibernate, Exploring the architecture of hibernate, hibernate O/R mapping (ORM), Hibernate Annotation, CRUD operation using Hibernate API.	[6]
Text Books: - 1. Herbert Schildt, JAVA: The Complete Reference", Ninth Edition, Oracle Press. Reference Books: - 1. Ivor Horton, Beginning JAVA, WileyIndia. 2. "Java: The Complete Reference" by Herbert Schildt 3. JAVA Programming, Black Book, DreamtechPress 4. Core Java Volume I & II, Author: Cay S. Horstmann, Publisher: Pearson 5. Beginning Hibernate Author: Joseph B. Ottinger, Jeff Linwood, Dave Minter Publisher: Apress 6. Spring Boot in Action- Author: Craig Walls, Publisher: Manning	




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23CS3502	PCC	Design Analysis and Algorithm	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of data structure

Course Outcomes: At the end of the course, students will be able to:

CO1	Illustrate basics and analyze performance of algorithms in terms of time complexity and space complexity.
CO2	Apply greedy Approach and Analyze the performance by taking different examples
CO3	Apply dynamic algorithms and analyze the performance by taking different examples.
CO4	Illustrate and apply algorithms using the backtracking technique to solve constraint satisfaction.
CO5	Illustrate tree and graph traversal techniques and outline the concepts of NP-Hard and NP-Complete problems.
CO6	Make use of branch and bound concepts, compare performance with backtracking.

Course Contents:

Unit 1: Introduction What is algorithm, Algorithm Specification, Performance Analysis, and Randomized Algorithm. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of non-recursive and recursive Algorithms with Examples, Fundamental Data Structures: Stacks, Queues, Graphs and Sets.	[6]
Unit 2: Divide and Conquer General method, Binary search, Recurrence equation for divide and conquer, finding the maximum and minimum, Merge sort, Quick sort, Selection sort and analysis of these algorithms. Advantages and Disadvantages of divide and conquer	[6]
Unit 3: Greedy Method The general method, Activity Selection Problem, Huffman Coding, Knapsack problem, Job sequencing with deadlines Minimum-cost spanning trees—Prim's and Kruskal's Algorithms Optimal storage tapes Optimal merge patterns analysis Single source shortest paths notations.	[6]





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Unit 4: Dynamic Programming Introduction, Characteristics of Dynamic Programming, Shortest paths: Bellman Ford, Floyd, Warshall, Multistage graphs, all pair shortest paths, Optimal binary search trees, 0/1 knapsack, Reliability design, Traveling Sales person problem.	[6]
Unit 5: Traversal, NP Hard and Complete Problems Techniques for Binary Trees, Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, AND/OR graphs; NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes	[6]
Unit 6: Backtracking General method, N-Queens problem, Sum of subsets problem Graph coloring Hamiltonian cycles. Branch and Bound: Travelling Sales Person problem, 0/1 Knapsack problem (T LC Branch and Bound solution, FIFO Branch and Bound solution.	[6]
Text books: - 1. Fundamentals of Computer Algorithms-Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Universities Press, Second Edition 2. Fundamentals of Algorithmics –Gilles Brassard, PaulBratley (Pearson Education). 3. Mastering Algorithms with C–Kyle Loudon (SPDO'Reilly). Reference books: - 1. Computer Algorithms-Introduction to Design and Analysis–SaraBaase, Allen VanGelder (Pearson Education). 2. Michel Goodrich, Roberto Tamassia, Algorithm Design–Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition, 2006 3. Cormen, Introduction to Algorithms, PHI Publication, 2 nd Edition, 2002. 4. SaraBase, Computer algorithms: Introduction to Design and Analysis, Addison-Wesley Publication, 2nd Edition	




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23CS3503	PCC	Advanced Database Engineering	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

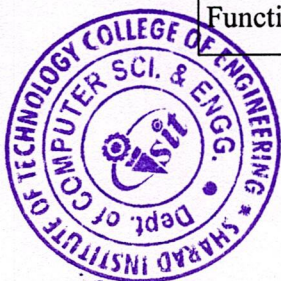
Pre-Requisites: DBMS

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the different types of database architectures.
CO2	Explain languages of Object based database.
CO3	Outline/solve FLOWER Expressions, joins, Nested Queries by using XQueries.
CO4	Compare SQL and NoSQL database system.
CO5	Examine Deductive and Active database Events, Conditions, Actions.
CO6	Choose the operations of multidimensional data model: OLAP.

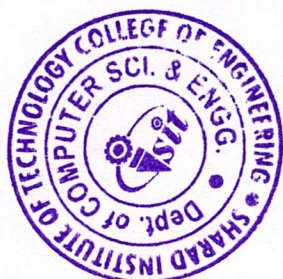
Course Contents:

Unit 1: Introduction to database Architecture Introduction to client-server Database Model: Two-Tier Client server model, Three-Tier Client server model. Parallel databases: Parallel database system architecture, Types of parallelism, Parallel Database Implementation. Distributed databases: Distributed database system architecture, Benefits of distributed database system, Issues with distributed database systems.	[6]
Unit 2: Object Based Database Object based database: Object Identity, Object structure, Type Constructors, Encapsulation of Operations, Methods, Persistence, Type and Class Hierarchies, Inheritance, table inheritance, Complex Objects, Languages and Design: ODMG Model, Object Definition Languages (ODL), Object Query Languages (OQL).	[6]
Unit 3: XML Introduction to XML, Structure of XML data, XML Document schema, Querying and Transformation, Xpath, XQuery: FLOWER Expressions, joins, Nested Queries, Functions and Types. Storage of XML Data.	[6]





Unit 4: Advanced Database Techniques. Structured versus Unstructured data. NoSQL database concepts: Types of NoSQL databases, comparison between SQL and NoSQL database system. NoSQL using MongoDB: Introduction to MongoDB Shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types, Embedded Documents. Querying with MongoDB: find() function, specifying which keys to return, query criteria, Types specific querying.	[6]
Unit 5: Deductive, Active, Multimedia database: Introduction to Multimedia Databases, Mobile Databases and digital databases, Deductive Database: Introduction to recursive queries, Datalog Notation, Clause Form and Horn Clauses, Active Database: Languages for rule specification: Events, Conditions, Actions, temporal database, spatial database.	[6]
Unit 6. Data Warehouse and OLAP Introduction to Decision support, Data Warehousing, Creating and maintaining a warehouse, OLAP: Multidimensional data model, OLAP Queries, Database design for OLAP, Implementation techniques for OLAP: Bitmap Indexes, Join Indexes, Views and decision support, Top N queries, Online aggregation, View Materialization: Issues.	[6]
Text books: - 1. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6th edition, McGraw- Hill. 2. "Database Systems - A Practical Approach to Design, Implementation and Management", Thomas Connolly, Carolyn Begg, 4th Edition, Addison Wesley. 3. "MySQL Cookbook", Paul DuBois, 3rd edition, O'REILLY. Reference books: - 1. "Principles of Database Systems", J. D. Ullman, 2nd Edition, Galgotia Publication, ISBN10: 0716780690, ISBN-13: 978-0716780694. 2. "Fundamentals of Database System", R. Elmasri and S. Navathe, , Pearson, 7th Edition, ISBN-10: 933258270X, ISBN-13: 978-9332582705 .	





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23CS3504	PCC	Advanced Java Programming Laboratory	0-0-2	1 Credit
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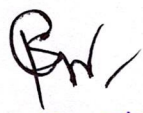
Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Java Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a GUI application using swing components.
CO2	Explain event-driven programming concepts by using appropriate event classes, listener interfaces.
CO3	Construct applications that interact with relational databases using JDBC for data connectivity, manipulation, and retrieval.
CO4	Take part in Servlets with HTML forms and databases for dynamic content generation.
CO5	Make use of Java Server pages to implement dynamic web pages.
CO6	Design database-driven applications using Hibernate ORM framework by applying concepts of object-relational mapping, annotations.




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Course Contents:

List of Experiment:

1. Develop a program to create login form using Swing Component.
2. Develop a program to demonstrate a progressbar showing progress value in percentage by using set values.
3. Develop a program to Implement Traffic signal(Red, Green and Yellow) by using Swing components (Using JFrame, JRadioButton, ItemListener etc.).
4. Develop a program to mouse motion adapter class to implement only one method mouyse dragged.
5. Develop a program using JDBC to display student's record (Enroll No, Name, Address, Mobile No,and Email-ID) into table 'StuRec'.
6. Develop a program using JDBC to edit (insert, update, delete) Student's profile stored in the database.
7. Develop a program simple servlet to display "Welcome to Servlet Programming".
8. Develop a program servlet that handles GET and POST methods differently.
9. Develop a servlet for demonstrating the concept of session and cookies.
10. Create a form that accepts the user's name and age. Display the submitted data on the next JSP page.
11. Write a JSP page that demonstrates the use of declaration, scriptlet, and expression.
12. Develop an application to store, update, fetch and delete data of Employee (NAME, AGE, SALARY and DEPARTMENT) using Hibernate CRUD operations.





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23CS3505	PCC	Design Analysis and Algorithms Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: C Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Design and implement algorithm by taking simple problems.
CO2	Design algorithm on greedy Approach and Analyze the performance.
CO3	Develop an algorithm on dynamic approach and analyze the performance.
CO4	Design algorithm by applying backtracking technique.
CO5	Design and Implement algorithm on Traversal technique.
CO6	Develop algorithm on branch and bound technique.




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Course Contents:

List of Experiments:

1. Sort a given set of n integer elements using Quick Sort method and compute its time complexity
2. Sort a given set of n integer elements using Merge Sort method and compute its time complexity
3. Sort a given set of n integer elements using selection Sort method and compute its time complexity
4. Search a given searching element using binary search algorithm.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.
6. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
7. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
8. Write Java programs to
 - 1) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.
 - 2) Implement Travelling Sales Person problem using Dynamic programming.
9. Design and implement DFS And BFS algorithms.
10. Implement N Queen's problem using BackTracking.




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23CS3506	PCC	Advanced Database Engineering Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: DBMS

Course Outcomes: At the end of the course, students will be able to:

CO1	Demonstrate the different types of database architectures.
CO2	Explain languages of Object based database.
CO3	Outline FLOWER Expressions, joins, Nested Queries by using XQueries.
CO4	Compare SQL and NoSQL database system.
CO5	Examine Deductive and Active database Events, Conditions, Actions.
CO6	Choose the operations of multidimensional data model: OLAP.

Course Contents:

List of Experiments:

1. Create database using XML attributes and elements.
2. Implement Query based on FLOWER expression and joins using XQuery.
3. Implement Query based functions and types using XQuery.
4. Implement queries using structured types in SQL.
5. Implement the query using type inheritance and table inheritance in SQL.
6. Implement the query using array and multiset types in SQL.
7. Design and develop MongoDB queries using basic operations.
8. Implement aggregations queries using MongoDB.
9. Implement MongoDB queries using find () function.
10. Install and configure any data mining tool like (WEKA) and use installed data mining tool.




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Program Elective Course-I

23CS3507A	PEC	Text and Speech Analysis	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

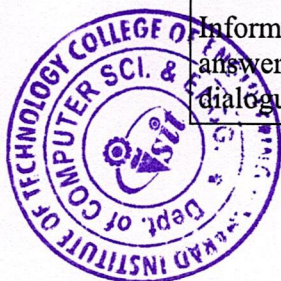
Pre-Requisites: Data Science

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify various techniques of natural language data.
CO2	Apply vector semantics and embedding techniques to classify text.
CO3	Develop question answering systems and dialogue systems by integrating information retrieval techniques.
CO4	Make use of various text-to-speech synthesis techniques
CO5	Apply the principles of acoustic modeling in automatic speech recognition systems
CO6	Analyze advanced Natural Language Processing (NLP) techniques

Course Contents:

Unit 1: Natural Language Basics Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model	[6]
Unit 2: Text Classification Vector Semantics and Embeddings, Word Embeddings – Word2Vec model – Glove model –Fast Text model. Overview of Deep Learning models, RNN, Transformers – Overview of Text summarization	[6]
Unit 3: Question Answering and Dialogue System Information retrieval – IR-based question answering – knowledge-based question answering –language models for QA – classic QA models – chatbots – Design of dialogue systems -evaluating dialogue systems	[6]





Unit 4: Text-to-Speech Synthesis Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing –Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems	[6]
Unit5: Automatic Speech Recognition Speech recognition: Acoustic modelling – Feature Extraction – HMM, HMM-DNN systems	[6]
Unit 6: Advanced NLP Techniques Named Entity Recognition (NER), Part-of-speech tagging, Bias in NLP and speech models, Privacy concerns and data ethics.	[6]
Reference books: - 1. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008. 2. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009 3. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining. 4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O'REILLY.	





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Program Elective Course-I

23CS3507B	PEC	Cloud Computing	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Computer Network, Database Management Systems

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline the different Cloud Computing environment.
CO2	Illustrate the architecture of Cloud Computing
CO3	Analyze virtualization technology and install virtualization software
CO4	Make use of appropriate data storage technique on Cloud based on Cloud application
CO5	Apply security in cloud applications
CO6	Develop and deploy applications on cloud

Course Contents:

Unit 1: Fundamentals of Cloud Computing Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Cloud Economics and Benefits, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing.	[6]
Unit 2: Cloud Architecture Cloud Deployment Models: public cloud, private cloud, hybrid cloud, cloud services models: SaaS, PaaS, IaaS, Architecture of cloud computing: Cloud System Architecture, Cloud Computing Logical Architecture, Layered cloud architecture design.	[6]





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Unit 3: Virtualization in Cloud Computing Definition of Virtualization, Adopting Virtualization, Types of Virtualizations, Virtualization Architecture and Software, Virtualization in Cloud, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization, Virtualization Application, Pitfalls of Virtualization.	[6]
Unit 4: Storage in Clouds Introduction to Enterprise Data Storage, Direct Attached Storage, Storage Area Network, Data Storage Management, File System, Cloud Data Stores, Data Management, Provisioning Cloud storage, Cloud Storage from LANs to WANs, Cloud Characteristics, Distributed Data Storage.	[6]
Unit 5: Security in Cloud Computing Cloud security Fundamentals, Risk Management, Types of Risks in Cloud Computing, Security Issues, Challenges, advantages, Disadvantages, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing	[6]
Unit 6: Cloud Platforms and Cloud Applications Cloud Platforms: Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Microsoft Cloud Services: Azure core concepts, SQL Azure. Cloud Computing Applications: Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Geosciences: Satellite Image Processing, Business and Consumer Applications: CRM and ERP, Social Networking, Google Cloud Application: Google App Engine.	[6]
Text Books: 1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN-13:978-1-25-902995-0 Reference Books: 1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill. 2. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson. 3. Thomas Erl with Eric Barcelo Monroy "Cloud Computing: Concepts, Technology And Architecture", 2024, Pearson.	




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Program Elective Course-I

23CS3507C	PEC	Cryptography	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline cryptographic principles, security attacks, and classical encryption techniques.
CO2	Demonstrate symmetric key encryption algorithms
CO3	Demonstrate asymmetric encryption techniques
CO4	Apply authentication requirements, hash functions, key management, and PKI.
CO5	Make use of integrity verification, digital signatures, and authentication protocols
CO6	Identify Kerberos authentication, its components, and cyber laws related to security

Course Contents:

Unit 1: Introduction to Cryptography Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.	[6]
Unit 2: Symmetric key Ciphers Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.	[6]
Unit 3: Asymmetric key Ciphers Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, and Knapsack Algorithm.	[6]





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Unit 4: Authentication requirements and Key Management Cryptographic Hash Functions: Message Authentication, Secure hash algorithm(SHA 512) Message Authentication Codes: Authentication requirements, HMAC, CMAC Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, X.509 Authentication Service, Public – Key Infrastructures.	[6]
Unit 5: (Integrity checks and Authentication algorithms) MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.	[6]
Unit 6: Kerberos Working - AS, TGS, SS, Common Attacks - Pass-the-Ticket Attack, Golden Ticket Attack, Silver Ticket Attack -Cyber laws – Crime against individual, Government, Property	[6]
Textbooks: 1. Cryptography and Network Security: William Stallings, Pearson Education,4 Edition 2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill Edition Reference Books: 1. Cryptography and Network Security: C K Shyamala, N Harin i, Dr T R Padmanabhan, Wiley India, 1" Edition. 2. Cryptography and Network Security: Forouzan Mukhopadhyay, MC Graw Hill, 2"" Edition 3. Information Security, Principles and Practice: Mark Stamp, Wiley India. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH. 4. Introduction to Network Security: Neal Krawetz, CENGAGE Learning Paradigms", Wiley publication, ISBN: 9788126570966	




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Program Elective Course-I

23CS3507D	PEC	Introduction to AI	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

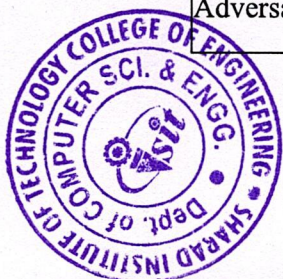
Pre-Requisites: Database Management System, Design Analysis of Algorithm

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain Fundamental Concepts & Challenges in AI.
CO2	Apply search methods that Agents can employ for problem solving.
CO3	Compare results of various Constraint Satisfaction Problems.
CO4	Model Adversarial Search, Games, Optimal Decisions in Games.
CO5	Illustrate Logical Agents with various example
CO6	Demonstrate Ethical Awareness in AI

Course Contents:

Unit 1: Introduction Introduction, What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Agents and Environments Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	[6]
Unit 2: Problem-solving Solving Problems by Searching, Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.	[6]
Unit 3: Constraint Satisfaction Problems Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.	[6]
Unit 4: Game Playing Adversarial Search, Games, Optimal Decisions in Games, Alpha-Beta Pruning.	[6]





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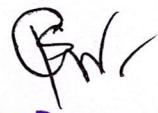
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Unit 5: Logical Agents Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic	[6]
Unit 6: AI Ethics and Future Trends Ethical Implications of AI: Bias in AI, AI and Privacy, AI in Warfare, Future of AI: Trends in AI research, AI in Autonomous Systems. AI Governance and Regulation: Ethical AI development frameworks.	[6]
Textbooks: 1. Rich, E. and Knight K.: Artificial Intelligence, Tata McGraw- Hill Reference Books: 1. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition. 2. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley	




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23CS3508	CEP	Mini Project III	0-0-2	01 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	Continuous Assessment-I: - 25 Marks Continuous Assessment-II: -25 Marks

Pre-Requisites: Mini Project, Mini Project II

About Hackathon

The project is a part of addressing societal and industrial needs. Hackathon is one of the platforms where students will solve real world challenges. This Course focuses on the selection of methods/engineering tools/analytical techniques for problem solving.

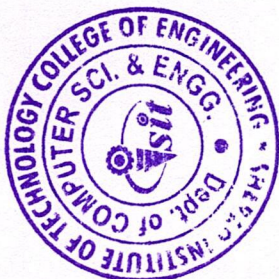
Through this course, students will gain the understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills and responsibility

Course Outcomes: At the end of the course, students will be able to:

CO1	Select the appropriate method for solving the problem
CO2	Make use of various engineering techniques and tools to give a solution
CO3	Justify the methods /tools used to develop the solution
CO4	Design / simulate the model/ project work
CO5	Describe the solution with help of a project report and presentation
CO6	Conclude the outcomes of project.

Course Contents:

Week 1: Survey Design-1 • Ensure case study group students have made necessary communication and done a preparatory visit. • Watch the lecture on survey design and study the notes. • Prepare a questionnaire and try it out with your group members as mock.	[2]
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Week 2: Survey Design-2 - Review survey questionnaire prepared by case study groups. - Decide sampling strategy. - Prepare a detailed schedule for fieldwork	[2]
Week 3: Fieldwork - Data Collection: Collect quantitative data (e.g., statistics, usage metrics) and qualitative data (e.g., user stories, testimonials). - Use data collection tools like questionnaires, observation checklists, and digital analytics. - Ensure data accuracy and reliability through proper sampling and recording methods. 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 4: Trails and Experimentation-1 - Initial Setup and Configuration - Concept Validation - Feasibility Testing	[2]
Week 5: Trails and Experimentation-2 - Prototyping - Functionality Testing	[2]
Week 6: Trails and Experimentation-3 - Bug Identification and Fixing - Integration Testing - Security Testing 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 7: Results - Coordinator has to check and verify below points in term of result: - Functional Performance - Accuracy and Precision - Efficiency - Safety	[2]
Week 8: Validation - Coordinator has to check and verify below points in term of validation: - Testing and Verification - Compliance with Standards 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]





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Week 9: Integration Testing • Validate that the hardware integrates seamlessly with other systems or components as intended • Perform compatibility tests with software, other hardware, and network systems.	[2]
Week 10: Documentation and Reporting • Maintain comprehensive documentation of design, development, testing, and validation processes • Provide detailed reports on test results, issues found, and corrective actions taken.	[2]
Week 11: Final Presentation • 100% Presentation has to be conducted by mentor/guide based on above activity. • Prototype/Final Software solution is mandatory at the time of final presentation along with report	[2]
Week 12: Exhibition • Mini project exhibition will be schedule with interdepartmental evaluation.	[2]





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Multidisciplinary Minor- III

23CSMDA3	MDM	Data Science for Agriculture	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

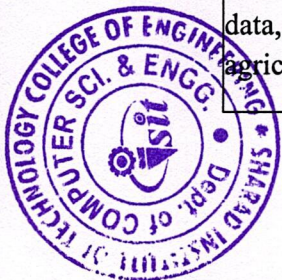
Pre-Requisites: Python, Data Science and visualization

Course Outcomes: At the end of the course, students will be able to:

CO1	Relate the role of data science in agriculture.
CO2	Outline process of data collection for various agricultural practices.
CO3	Apply preprocessing techniques on agricultural data.
CO4	Identify use of remote sensing and GIS tools for smart farming.
CO5	Explain IoT-based farming for Precision Agriculture.
CO6	Select Time series techniques for Predictive Analysis.

Course Contents:

Unit 1: Introduction to Data Science in Agriculture Role of data science in agriculture, Basics of agricultural data (Soil, Weather, Crop Yield, Pests, Diseases), Big data in agriculture, Data-driven decision-making in agriculture, Challenges in agricultural data analysis.	[6]
Unit 2: Data Collection Sources of agricultural data (Satellite, IoT, Sensors, Drones), Types of Agricultural Data, Soil parameters (moisture, pH, nutrients), Weather data (temperature, humidity, rainfall), Crop health & growth monitoring, Disease & pest control data, Smart farming with IoT and Edge AI. Importance of AI & machine learning in farming.	[6]
Unit 3: Data Preprocessing Data cleaning, transformation, and visualization, Feature engineering for crop and soil data, Handling missing values, outliers, and noise, Feature selection & engineering for agricultural datasets, Data normalization.	[6]





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Unit 4: Remote Sensing and GIS in Agriculture Use of satellite imagery for crop monitoring, GIS-based mapping of soil and land fertility, NDVI (Normalized Difference Vegetation Index) for plant health analysis, NDVI (Normalized Difference Vegetation Index), SAVI, EVI for crop stress detection.	[6]
Unit 5: Precision Agriculture and IoT Sensors for soil moisture, pH, and temperature monitoring, IoT architecture for agriculture, Wireless sensor networks (WSN) for farm monitoring Drone-based data collection and analysis, Smart irrigation & automated fertilization systems.	[6]
Unit 6: Time-Series and Predictive Analytics ARIMA, LSTM, Prophet models for crop yield forecasting, predicting rainfall & temperature variations, Forecasting crop yields using time-series models, Weather prediction for agricultural planning, AI-based decision support systems for farmers.	[6]
Text Books: 1. "Data Science from Scratch (First Principles with Python)", Joel Grus, O'Reilly Publication. 2. "Textbook of Agricultural Meteorology" by H. S. Mavi, 2nd ed. (Oxford & IBH, 1994) 3. S.R. Reddy – "Principles of Agronomy" Reference Books: 1. "Data Science in Agriculture and Natural Resource Management", G. P. Obi Reddy · Mehul S. Raval · J. Adinarayana · Sanjay Chaudhary 2. "Data-Driven Precision Agriculture Opportunities and Challenge", Wenxuan Guo, Song Cui, Jessica Torrion, and Nithya Rajan. 3. A.K. Dahama, "Organic Farming for Sustainable Agriculture" (Agrobios, Jodhpur, 2nd Edition, 2009)	





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Multidisciplinary Minor- III

23CSMDB3	MDM	Innovation, Business Models and Entrepreneurship	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Summarize the fundamentals of innovation.
CO2	Demonstrate the marketing of innovation.
CO3	Illustrate the concept of business model.
CO4	Explain the role of entrepreneurship in business model.
CO5	Illustrate Competencies required to become an entrepreneur.
CO6	Outline of management of innovation.

Course Contents:

Unit 1: Innovation & Creativity Innovation Concept, Characteristics of Innovation, Importance of Innovation, Principles of Innovation, Process of Innovation. Scope of Innovation, Challenges of Innovation, Steps of Innovation Management, Idea Management System, Innovation in Current Environment, Types of Innovation.	[6]
Unit 2: Marketing of Innovation Idea Management System, Divergent Vs Convergent Thinking, Levers of Idea Management, Experimentation in Innovation Management, Participation for Innovation, Co-creation for Innovation, Technology Innovation Process, Technological Innovation Management Strategies, Technology Forecasting.	[6]
Unit 3: Business Model Search for a business idea- How to choose an idea- Product idea- selection of product, the adoption process- Product innovation- Production, planning and development strategy, Design of production system- Types of production system.	[6]





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Unit 4: Introduction to Entrepreneurship Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur. - Entrepreneur vs Manager- role of entrepreneurship in economic development – Barriers to entrepreneurship.	[6]
Unit 5: The Entrepreneur Types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development program (EDP)- Evaluation of EDP - Entrepreneur development training.	[6]
Unit 6: Management of Innovation Creation of IPR, Management of Innovation, creation of IPR, Types of IPR, Patents in India, Copyrights and other important IPR. Future markets and Innovation needs for India.	[6]
Text Books: 1. James A Christiansen, "Competitive Innovation Management", published by Macmillan Business, 2000. 2. Paul Trott, "Innovation Management & New Product Development", published by Pitman, 2000. 3. Kelley, Tom, Jonathn Littman, and Tom Peters. The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm. New York: Doubleday, 2001. Reference Books: 1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition 2. Production & operations Management- Kanishka Bedi. 2. Marketing Management- Philip Kotler. 3. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock, Gerard George.	





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Multidisciplinary Minor- III

23CSMDC3	MDM	Telemedicine and Remote Patient Monitoring	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

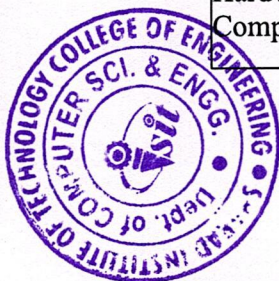
Pre-Requisites: Python, Data Science and Visualization

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline basics of telemedicine.
CO2	Explain the key components of a telemedicine system.
CO3	Outline the key components of the hardware platform for telemedicine.
CO4	Develop strategies to integrate AI tools into healthcare.
CO5	Develop healthcare service coordination strategies that utilize wearable IoT devices.
CO6	Analyze future trends in telemedicine.

Course Contents:

Unit 1: Introduction to Telemedicine What is Telemedicine, Applications of Telemedicine, Modes of Communication available in Telemedicine, Benefits of Telemedicine to patients, Limitations of Telemedicine, Telemedicine in India, Types of telemedicine, Challenges, How Telehealth Services are Reshaping Healthcare.	[6]
Unit 2: Telemedicine Infrastructure and Delivery Modes Telemedicine System (Types of information in telemedicine, Process), Components of Telemedicine System (Telemedicine Platform: information technology infrastructure, Clinical/medical devices, Video Conferencing equipment, software requirement, connectivity and communication system), Delivery modes in telemedicine (store and forward telemedicine, real-time telemedicine, Hybrid System, Remote monitoring)	[6]
Unit 3: Information Systems and Cloud Computing in Telemedicine Information Sources in telemedicine system, Data Transmission (EMR, PHR, EHR), Hardware Platform for Telemedicine, Workstation for telemedicine, Client-server Computing and cloud computing in telemedicine.	[6]





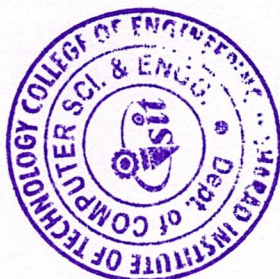
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Unit 4: Health care with AI Introduction, positive effects of AI in healthcare, using AI to improve health in Areas such as illness, prevention, detection & treatment, Providing healthcare to patients - Technical perspectives –healthcare provider, end users, authorities biomedical sensors: ECG, EEG, blood pressure, temperature, and glucose monitoring.	[6]
Unit 5: Advancements in IoT-Based Healthcare Attributes of SHM & IOMT, Framework, data security, remote heart rate tracking sensor enabled IoT based devices, superior medical technology, service coordination in healthcare, Wearable devices for remote monitoring: Smart watches, fitness bands, and medical-grade sensors.	[6]
Unit 6: Case Studies and Real-World Applications Telemedicine implementations in different regions and specialties, Case studies from healthcare providers, hospitals, and startups, challenges faced by telemedicine projects. Future trends: 5G, AI-powered telemedicine, and virtual health assistants.	[6]
Reference/Text books: - 1. Telemedicine: Technology and Applications (mHealth, TeleHealth and eHealth) by R. S. Khandpur 2. Remote Patient Monitoring: A Computational Perspective in Healthcare by Rishabha Malviya , Priyanshi Goyal . 3. Telemedicine: A Gateway To Health Care by Aryan Chaudhary 4. Remote Patient Monitoring: Technologies and Applications" by Sanjay Sharma and Rajendra Prasad Yadav 5. Health Informatics: A Systems Perspective" by Eliot S. L. H. Rees	





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23HSSM05	VEC	Aptitude Skills- III	1-0-0	Audit
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Teaching Scheme:	Evaluation Scheme:
Lecture: 1 Hrs/Week	CA I:25 Marks CA II: 25 Marks

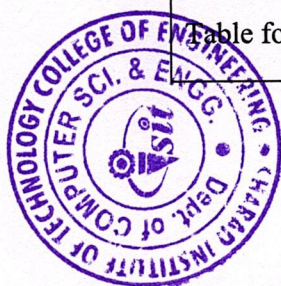
Pre-Requisites: Aptitude Skills-I and II

Course Outcomes: At the end of the course, students will be able to:

CO1	Solve the problems on system of equation
CO2	Solve the problems on seating arrangement
CO3	Solve the logical reasoning problems
CO4	Solve the critical analysis problems
CO5	Solve the problems of Data interpretation
CO6	Solve the problems permutations and combinations

Course Contents:

Unit 1: System of equations Quadratic equations, Surds and indices, solution of equations, Ages,	[2]
Unit 2: Seating Arrangements Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement	[2]
Unit 3: Logical Reasoning Numerical based on sense of direction, Blood relations, Odd man Out	[2]
Unit 4: Critical analysis Clocks and Calendar based problems, Cryptarithmic, heights and distances	[2]
Unit 5: Data Interpretation Table form, Bar form, Line for Pi chart form	[2]





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Unit 6: Permutation and combination	
Permutation and combinations	[2]
Text Books: 1. RS Aggarwal, "Quantitative Aptitude for Competitive Examinations ", S. Chand Publisher; 2016 edition. 2. Quantitative Aptitude for CAT TMH Publications 3. Vedic Maths Made Easy By Dhaval Bhatiya Jaico Publication House. Reference Books: 1. Rao N,D,V,Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017 2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition 3. RS Aggarwal, Objective General English, S. Chand Publisher; 2016 edition	





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23HSSM06	VEC	Language Skill- III	0-0-2	Audit
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Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs/week	CA I: 25 Marks CA II: 25 Marks

Pre-Requisites: Language Skill I & II

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a program to read input and return output.
CO2	Develop a program using data types, Strings and variables
CO3	Develop a program using Unary, Binary and Ternary operator
CO4	Develop a program using Conditional and Logical statements.

Course Contents:

1. Write a Python program to print "Hello, World!" ○ Objective: Understand basic syntax, indentation, and output.	[2]
2. Write a program to demonstrate the use of different types of comments in Python. ○ Objective: Single-line and multi-line comments.	[2]
3. Write a Python program that declares different types of variables and displays their data types using the type() function. ○ Objective: Variables, data types, and type identification.	[2]
4. Write a program to demonstrate type casting and type conversion between int, float, and string. ○ Objective: Type conversion, casting functions.	[2]
5. Write a Python script to perform string operations such as slicing, concatenation, upper(), lower(), and len(). ○ Objective: String manipulation and built-in functions.	[2]





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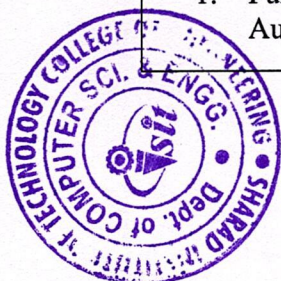
6. Write a program to demonstrate the use of all arithmetic, logical, and bitwise operators. ○ Objective: Operator functionality.	[2]
7. Write a Python program to use membership and identity operators with examples. ○ Objective: in, not in, is, is not.	[2]
8. Write a Python program using a ternary operator to find the larger of two numbers. ○ Objective: Conditional (inline) expressions.	[2]
9. Write a program that takes user input for age and prints whether the person is a child, teenager, adult, or senior citizen using if-elif-else. ○ Objective: Conditional statements and user input.	[2]
10. Write a program to find the sum of the first 10 natural numbers using a while loop. ○ Objective: Looping with while.	[2]
11. Write a Python script to display the multiplication table of a number using a for loop. ○ Objective: Looping with for and range().	[2]
12. Write a program that uses break, continue, and pass statements in appropriate looping scenarios. ○ Objective: Loop control statements.	[2]

Text Books:

1. Python Projects (Author: Laura Cassell, Alan Gault) Wrox publication
2. murach's Python Programming. Aut.:Michael Urban, Joel Murach, murach's Publication.

Reference Books:

1. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2nd Edition. Author: K.A. Kambert.





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Department: Computer Science Engineering

Rev: Course Structure/01/NEP/2023-24

Class: T.Y. B. Tech.

Semester: VI

Sr No	Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
1	23CS3601	PCC	Machine Learning	3	-	-	3	10	10	30	50	100	3
2	23CS3602	PCC	Software Testing	2	-	-	2	10	10	30	50	100	2
3	23CS3603	PCC	Internet-of-Things	3	-	-	3	10	10	30	50	100	3
4	23CS3604	PEC	Program Elective Course-II	3	-	-	3	10	10	30	50	100	3
5	23CS3605	PEC	Program Elective Course-III	3	-	-	3	10	10	30	50	100	3
6	23CS3606	PCC	Machine Learning Laboratory	-	-	2	2	15	15	-	20	50	1
7	23CS3607	PCC	Software Testing Laboratory	-	-	2	2	15	15	-	20	50	1
8	23CS3608	PCC	Internet-of-Things Laboratory	-	-	2	2	15	15	-	20	50	1
9	23CS3609	PROJ	Mega Project Phase-I	-	-	4	4	25	25	-	50	100	2
10	23CSMDXX	MDM	Multidisciplinary Minor-IV	3	-	-	3	10	10	30	50	100	3
11	23HSSM07	VEC	Aptitude Skills-IV	1	-	-	1	25	25	-	-	50	Audit
12	23HSSM08	VEC	Language Skills-IV	-	-	2	2	25	25	-	-	50	Audit
13	23CS3610	MC	Constitution of India	1	-	-	1	25	25	-	-	50	Audit
Total				19	-	12	31	205	205	180	410	1000	22

Multidisciplinary Minor-IV

Basket	Agriculture	Management	Healthcare
Course Code, Name	Crop Modeling & Prediction (23CSMDA4)	Engineering Economics (23CSMDB4)	Healthcare Cyber Security and Privacy (23CSMDC4)

Program Elective Course-II

23CS3604A) Business Analytics
 23CS3604B) Cloud Services Management
 23CS3604C) Cyber Security
 23CS3604D) Optimization Techniques

Program Elective Course-III

23CS3605A) Image & Video Analytics
 23CS3605B) Cloud Warehouse
 23CS3605C) Ethical Hacking
 23CS3605D) Soft Computin



(Signature)
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23CS3601	PCC	Machine Learning	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I:10 Marks CA II:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Statistics, Data Science.

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline basics of machine learning to implement various algorithms.
CO2	Apply different supervised learning algorithms for solving the problems.
CO3	Apply clustering algorithm and identify its applicability in real life problems.
CO4	Analyze suitable hypothesis by choosing correct theory among different theories.
CO5	Explain the fundamentals of deep neural networks.

Course Contents:

Unit 1: Introduction to Machine Learning Well-posed learning problems, types of learning, hypothesis space and inductive bias, Machine Learning Lifecycle, Basic ML concepts- labels, training/testing sets, Evaluation & Performance Metrics, Cross-validation, Applications of Machine Learning.	[6]
Unit 2: Supervised Learning I Basics of supervised learning, Simple & Multiple Linear Regression, Decision Tree, K-Nearest Neighbor, Overfitting, Underfitting.	[6]





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Unit 3: Supervised Learning II Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM, Probability and Bayes learning.	[6]
Unit 4: Unsupervised Learning Basics of unsupervised learning, Clustering- K-Means Clustering, Hierarchical Clustering, DBSCAN, Dimensionality Reduction- Principal Component Analysis (PCA), Recommendation System.	[6]
Unit 5: Computational Learning Theory Definition and significance of Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.	[6]
Unit 6: Introduction to Deep Neural Networks Structure of a Neural Network, Perceptron, Importance of weights, biases, and activation functions, Multilayer Networks and Back Propagation, Deep Neural Networks-Introduction to CNN and RNN.	[6]
Reference books: - • Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997. • Introduction to Machine Learning, 2nd Edition, by Ethem Alpaydin	




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23CS3602	PCC	Software Testing	2-0-0	2 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week	CA I:10 Marks CA II:10 Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-Requisites: Project Work

Course Outcomes: At the end of the course, students will be able to:

CO1	Apply various software testing methods.
CO2	Prepare test cases for different types and levels of testing.
CO3	Prepare test plan for given applications.
CO4	Identify bugs to create defect report of given application.
CO5	Test software for performance measures using automated testing tools.

Course Contents:

Unit 1: Basic of software testing and Testing Methods Software Testing, Objective of Testing, Failure, Error, Fault, Defect, Bug Terminology, Test case, When to Start and Stop Testing of Software (entry and exit criteria), Verification and validation (V Model), Quality Assurance, Quality control, Methods of testing: static and dynamic testing, The box approach: White Box testing: Inspections, Walkthroughs, Technical Reviews, Functional Testing, Code coverage testing, Code complexity testing, Black Box Testing: Requirement Based Testing, Boundary Value Analysis, Equivalence Partitioning.	[6]
Unit 2: Types And Levels of Testing Levels Of testing, Unit Testing: Unit test Planning, Designing, Running the unit test and Recording result, Integration testing: Integration test planning, Designing, Testing on web application: Performance testing, stress testing, Security testing, Client-server-testing, Acceptance Testing: Alpha Testing and Beta Testing, Special Test: Regression Testing and GUI Testing.	[6]

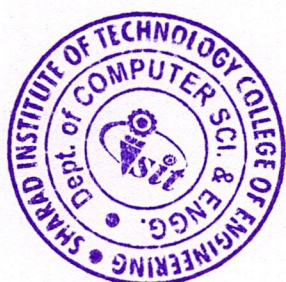




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Unit 3: Test Management Test Planning: Preparing a Test Plan, Deciding Test Approach, Setting Up Criteria for Testing, Identifying Responsibilities, Staffing, Resource Requirements, Test Deliverables, Testing Tasks, Test Management: Test Infrastructure Management, Test People Management, Test Process: Base Lining a Test Plan, Test Case Specification, Test Reporting: Executing Test Cases, Preparing Test Summary Report.	[4]
Unit 4: Defect Management Defect Classification, Defect Management Process, Defect Life Cycle, Defect Template, Estimated Expected Impact of a Defect, Techniques for Finding Defects, Reporting a Defect.	[4]
Unit 5: Test Automation Software test automation, Skills needed for automation, Scope of automation, Design and Architecture for Automation, Requirements for a test tool, Challenges in Automation, Test Metrics and measurements, Project, Progress and productivity metrics.	[4]
Text Books: - 1. Software testing: Yogesh Singh, Cambridge University Press, First Edition Software testing: Yogesh Singh, Cambridge University Press, First Edition. 2. Software Testing: Principles. Front Cover. M. G. LIMAYE. Tata McGraw Hill Education Private Limited, 2009.	
Reference Books: - 1. Principles & Practices. Gopalaswamy Ramesh and <i>Srinivasan Desikan</i> . • Managing Global Software Projects. Gopalaswamy Ramesh.	





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23CS3603	PCC	Internet of Things	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Data Communication, Computer Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain how to design and develop Applications in IOT.
CO2	Explain the specifications and functionalities of various protocols/standards of IOT
CO3	Illustrate Working Principals of Different IOT devices
CO4	Develop simple IOT Applications
CO5	Demonstrate Applications of IOT using Adriano & Raspberry Pi
CO6	Elaborate Simple basic Case studies of IOT

Course Contents:

Unit 1: Introduction to the Internet of Things Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation.	[6]
Unit 2: IOT and Communication Protocols Basics of Networking, Communication Protocols, Sensor Networks, Machine-to-Machine Communications and IoT Technology, Fundamentals Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.	[6]
Unit 3: Interoperability in IoT Hardware Components Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces, Software Components Programming API's (using Python Programming).	[6]



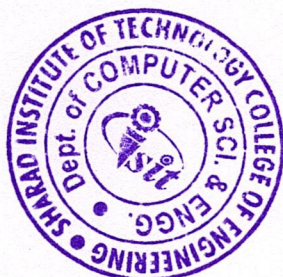
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Unit 4: IoT Application Development Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration.	[6]
Unit 5: IoT Physical Devices and Endpoints Building IoT with Arduino: Arduino-Interfaces-Arduino IDE-Programming, Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python, Wireless Temperature Monitoring System Temperature Sensor.	[6]
Unit 6: IoT Case Studies IoT case studies and mini projects based on Industrial Automation, Transportation, Agriculture, Healthcare, Home Automation, and Smart Cities.	[6]
Textbooks: - 1. Arashdeep Bahga, Vijay Madisetti Internet of Things a Hands-on Approach, University Press. 2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs 3. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.	
Reference Books: - 1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press 2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi 3. Adrian McEwen, "Designing the Internet of Things", Wiley 4. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill 5. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.	





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Program Elective Course-II

23CS3604A	PEC	Business Analytics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Basic data science and visualization, python programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline the fundamentals of Business Analytics.
CO2	Illustrate managing resources for business analytics.
CO3	Identify the appropriate techniques for the analytics scenario
CO4	Make a use of logic and Data Driven Models for Predictive Analysis
CO5	Explain Prescriptive analytics and Prescriptive Modeling in business analytics.
CO6	Determine implementation and future of business analytics.

Course Contents:

Unit 1: Introduction To Business Analytics (Ba) Business Analytics - Terminologies, Process, Importance, Relationship with Organizational Decision Making, Analytics in Decision Making, BA for Competitive Advantage.	[6]
Unit 2: Managing Resources for Business Analytics Managing BA Personnel, Data and Technology. Organizational Structures aligning BA. Managing Information policy, data quality and change in BA.	[6]
Unit 3: Descriptive Analytics Introduction to Descriptive analytics – Visualizing, and Exploring Data - Descriptive Statistics - Sampling and Estimation - Probability Distribution for Descriptive Analytics - Analysis of Descriptive analytics.	[6]
Unit 4: Predictive Analytics Introduction to Predictive analytics - Logic and Data Driven Models - Predictive Analysis Modeling and procedure - Data Mining for Predictive analytics. Analysis of Predictive analytics.	[6]





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Unit 5: Prescriptive Analytics Introduction to Prescriptive analytics - Prescriptive Modeling - Non-Linear Optimization - Demonstrating Business Performance Improvement.	[6]
Unit 6: implementation and future of business analytics Implementing Business Analytics, Change Management in BA, Business Analytics Tools and Platforms, Ethical and Legal Considerations in BA, Trends and Future of Business Analytics.	[6]
Textbooks: - 1. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014 2. 2. James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed, 2012.	
Reference Books: - 1. Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.	



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Program Elective Course-II

23CS3604B	PEC	Cloud Services Management	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Database Management System

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the essential characteristics of cloud computing.
CO2	Outline the fundamental elements of a comprehensive cloud strategy.
CO3	Apply fundamental principles to the design of effective and efficient cloud services.
CO4	Apply different Cloud Cost Models to forecast and manage cloud expenses.
CO5	Identify key components of a Cloud Governance Structure, including roles, responsibilities, and organizational units involved.
CO6	Analyze the challenges and strategies involved in managing Multi-Cloud and Hybrid Cloud environments.

Course Contents:

Unit 1: Fundamentals of Cloud Service Management Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives.	[6]
Unit 2: Cloud Services Strategy Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.	[6]
Unit 3: Cloud Service Management Processes Cloud Service Reference Model, Cloud Service Lifecycle, Basics of Cloud Service Design, Cloud Service Deployment and Migration, Cloud Service Operations Management, Cloud Service Level Management and Service Assurance, DevOps in a Hybrid IT and Cloud Computing Environment.	[6]

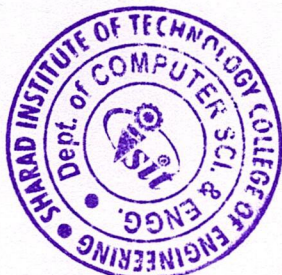


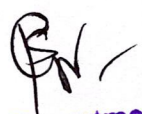


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Unit 4: Cloud Service Economics Pricing Models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription-based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models, Hybrid IT Cost Model.	[6]
Unit 5: Cloud Service Governance & Value IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.	[6]
Unit 6: Emerging Trends Cloud Native Applications, Serverless Computing (FaaS), Containerization (Docker, Kubernetes, Cloud Automation, AI and Machine Learning in Cloud Management, Edge Computing, Multi-Cloud and Hybrid Cloud Management.	[6]
Reference Books: - 1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing. 2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi.	




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Program Elective Course-II

23CS3604C	PEC	Cyber Security	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Computer Networks, Operating System

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamental concepts of cyber security including the threat landscape, types of threat actors and their motivations.
CO2	Outline key concepts of network security, including the TCP/IP model, DNS, ports and protocols, firewalls
CO3	Apply system security techniques including OS hardening for Windows and Linux, antivirus and EDR tools
CO4	Make Use of security tools for log analysis, event correlation, and monitoring using SIEM platforms like Splunk and ELK Stack
CO5	Analyze cyber security laws and standards including Indian IT Act 2000, GDPR, HIPAA, and ISO/IEC 27001; and evaluate risk.
CO6	Illustrate emerging trends in cyber security such as cloud security principles, Zero Trust Architecture.

Course Contents:

Unit 1: Introduction to Cyber Security Introduction Cyber Security, Threat landscape, actors, motivations, CIA triad, asset classification, Types of attacks: phishing, ransom ware, insider threats, Introduction to security policies.	[6]
Unit 2: Network Security Fundamental TCP/IP, DNS, ports and protocols, Firewalls and rule-based access control, IDS/IPS (Snort, Suricata) DoS, MITM, sniffing.	[6]

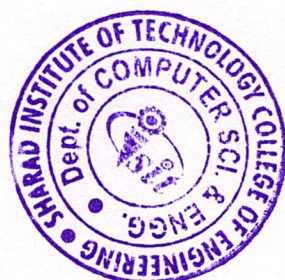




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Unit 3: Endpoint and System Security OS hardening (Windows and Linux), Antivirus, EDR tools, Patch and vulnerability management, Secure configurations (CIS Benchmarks).	[6]
Unit 4: Security Tools and Monitoring Log analysis and event correlation, SIEM basics (Splunk, ELK Stack), Honeypots and deception tech, Malware sandboxing.	[6]
Unit 5: Cyber Laws, Compliance, and Risk Management Indian IT Act 2000, GDPR, HIPAA, ISO/IEC 27001, Risk assessment methodology (CVSS, STRIDE), Security audits and incident response, Vulnerability management lifecycle.	[6]
Unit 6: Emerging Trends and Careers Cloud security basics (shared responsibility, IAM), Zero Trust Architecture, AI in cyber security, Career paths: SOC, DFIR, Threat Intelligence.	[6]
Reference Books: - 1. Cybersecurity Essentials – Charles J. Brooks et al. 2. Computer Security: Principles and Practice – William Stallings 3. Network Security Essentials – William Stallings 4. Hands-On Cybersecurity for Beginners – Dr. Erdal Ozkaya	




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Program Elective Course-II

23CS3604D	PEC	Optimization Techniques	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Linear Algebra, Calculus, Discrete Mathematics, Graph Theory, Probability and Statistics, Network Modeling

Course Outcomes: At the end of the course, students will be able to:

CO1	Summarize the techniques and applications of Engineering optimization
CO2	Apply linear programming problems (LPP)
CO3	Evaluate Integer Programming Problems, Transportation and Assignment Problems.
CO4	Evaluate solution to network problems using CPM and PERT techniques
CO5	Elaborate various function subject to the constraints.
CO6	Identify and solve problems under Markovian queuing models

Course Contents:

Unit 1: Introduction and Basic Concepts An Introduction, Application of differential Calculus to Optimization Problem, Operation Research, Meaning and definition, Models, Operations, Phases, Characteristics, Significance, Techniques, Limitations, Application.	[6]
Unit 2: Linear Models Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method.	[6]




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Unit 3: Integer Programming and Transportation Problem Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem.	[6]
Unit 4: Project Scheduling Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.	[6]
Unit 5: Classical Optimization Theory Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.	[6]
Unit 6: Queuing Models Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.	[6]
Text Books: 1. Dr. Pawan Kumar Oberoi: Optimization Techniques. 2. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International P) Ltd., New Delhi, 2000. 3. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017. 4. H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992.	
Reference Books: 1. D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 3rd Ed., Springer India, 2010. 2. M. S. Bazarrar, J.J. Jarvis, and H.D. Sherali, Linear Programming and Network Flows, 4th Ed., 2010. (3rd ed. Wiley India 2008). 3. U. Faigle, W. Kern, and G. Still, Algorithmic Principles of Mathematical Programming, Kluwe, 2002. D.P. Bertsekas, Nonlinear Programming, 2nd Ed., Athena Scientific, 1999. 4. M. S. Bazarrar, H.D. Sherali, and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, 3rd Ed., Wiley, 2006. (2nd Edn., Wiley India, 2004). 5. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.	





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Program Elective Course-III

23CS3605A	PEC	Image & Video Analytics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

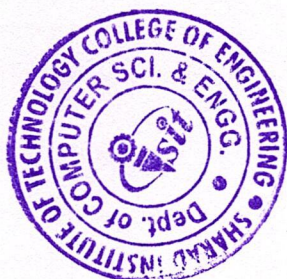
Pre-Requisites: - Basic data science and visualization, python programming.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamentals of image and video analytics.
CO2	Apply image processing techniques such as filtering, segmentation, and feature extraction using appropriate tools and libraries.
CO3	Analyze video data to perform motion detection, object tracking, and frame-level processing for real-time applications.
CO4	Choose deep learning-based models for object detection and action recognition in images and videos.
CO5	Evaluate the effectiveness of analytics models through case studies and interpret results in different domains.
CO6	Select different Platforms for image and video analytics.

Course Contents:

Unit 1: Introduction To Image and Video Analytics Basics of digital images and videos, Introduction to computer vision and analytics, Applications of image and video analytics in industries, Overview of analytics workflow: acquisition, preprocessing, analysis, interpretation, Tools and libraries: OpenCV, Pillow, Scikit-image, FFmpeg.	[6]
Unit 2: Image Processing Techniques Image acquisition, color spaces, and formats. Image enhancement: filtering, histogram equalization, thresholding. Edge detection, segmentation, morphological operations. Feature extraction: key points, contours, histograms of gradients (HOG). Image transformation: affine, perspective, geometric.	[6]

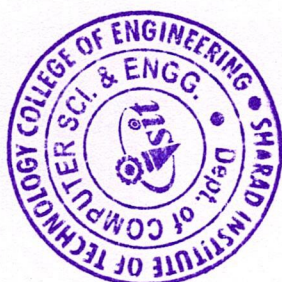


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Unit 3: Video Analytics Fundamentals Video structure and formats, Frame extraction and processing, Background subtraction and motion detection, Object detection and tracking in video, Applications in surveillance, traffic monitoring, and event detection.	[6]
Unit 4: Deep Learning for Image and Video Analytics Introduction to Convolutional Neural Networks (CNNs), Architectures: LeNet, AlexNet, VGG, ResNet, Transfer learning and fine-tuning, Object detection models: R-CNN, Fast R-CNN, YOLO, SSD. Action recognition in video: RNNs, 3D CNNs, Transformers.	[6]
Unit 5: Real-World Applications & Case Studies Facial recognition systems, medical imaging analytics, Retail & customer behavior analysis through CCTV, Video summarization and highlight detection, Emotion detection and scene classification.	[6]
Unit 6: Trends, Tools, And Ethics in Image & Video Analytics AI and ML advancements in vision-based analytics, Real-time processing and edge computing, Introduction to tools/platforms: OpenCV, TensorFlow, Keras, PyTorch, AWS Rekognition, Google Cloud Vision, Privacy, surveillance ethics, and responsible use of vision systems, Future directions: AR/VR, multimodal analytics, smart cities.	[6]
Reference Books: - 1. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods, Pearson Education 2. "Programming Computer Vision with Python" by Jan Erik Solem O'Reilly Media 3. "Hands-On Image Processing with Python" by Sandipan Dey Packt Publishing	



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Program Elective Course-III

23CS3605B	PEC	Cloud Warehouse	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Basics of Cloud Computing.

Course Outcomes: At the end of the course, students will be able to:

CO1	Define the fundamental concepts and evolution of data warehousing.
CO2	Outline the basic pricing structures associated with each of the major cloud data warehousing platforms.
CO3	Explain different data ingestion strategies based on data volume and velocity requirements.
CO4	Discuss cost management strategies for data storage within cloud data warehousing platforms.
CO5	Apply appropriate scaling techniques to address a given scenario of increasing data volume or user concurrency in a cloud data warehouse environment.
CO6	Utilize a cloud-based analytics service (e.g., running SQL queries in AWS Athena or Google BigQuery) to directly query data within a cloud data warehouse for ad-hoc analysis.

Course Contents:

Unit 1: Introduction to cloud Warehousing Purpose and architecture of a data warehouse, OLTP vs OLAP, Star and Snowflake schema, ETL vs ELT processes, cloud Service models: IaaS, PaaS, SaaS Deployment models: Public, Private, Hybrid, Multi-cloud, Cloud vendors overview: AWS, Azure, GCP.	[6]
Unit 2- Introduction to Cloud Data Warehousing Platforms Definition, characteristics, and evolution of data warehousing, Importance and benefits of data warehousing for business intelligence, platforms: Amazon Redshift: Architecture, features, use cases, and ecosystem. Microsoft Azure Synapse Analytics: Architecture, integrated services, use cases, and ecosystem.	[6]



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Unit 3: Data Acquisition Cloud-based ETL/ELT tools and services (e.g., AWS Glue, Azure Data Factory, Google Cloud Dataflow, Informatica Cloud, Talend Cloud). Data pipelines for batch and real-time data ingestion. Data transformation and cleansing techniques in the cloud environment. Orchestration and scheduling of data pipelines.	[6]
Unit4: Data Storage and Management in Cloud Data Warehouses Columnar data storage and its benefits for analytical queries, Data partitioning and indexing strategies for performance optimization, Data compression techniques, Data lifecycle management and archiving in the cloud.	[6]
Unit 5: Scalability, Security and Governance in Cloud Data Warehouses Horizontal and vertical scaling, Automatic scaling and resource management, Cost optimization strategies based on usage, Cloud security best practices and the shared responsibility model, Identity and Access Management (IAM) in the context of data warehousing, Data encryption at rest and in transit, Data governance policies, data quality, and metadata management in the cloud.	[6]
Unit 6: Integration with Business Intelligence (BI) and Analytics Tools Connecting popular BI tools (e.g., Tableau, Power BI, Looker) to cloud data warehouses. Cloud-based analytics services (e.g., Amazon Athena, Azure Analysis Services, Google Cloud AI Platform). Integration with machine learning and AI platforms in the cloud.	[6]
Textbooks: - 1. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy Ross. 2. The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data" by Ralph Kimball and Joe Caserta.	
Reference Books: - 1. Platform-specific books or whitepapers from each vendor (search on their websites or Amazon/Google Books). 2. Documentation for each cloud ETL service (AWS Glue, Azure Data Factory, Google Cloud Dataflow, Snowflake documentation). 3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif.	



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Program Elective Course-III

23CS3605C	PEC	Ethical Hacking	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Basics of computer Networks

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the types of hackers, the phases of hacking including reconnaissance, scanning, gaining and maintaining access, and clearing tracks.
CO2	Illustrate reconnaissance techniques by performing passive and active foot printing using tools like Whois, Shodan.
CO3	Apply system hacking techniques such as password cracking using dictionary, brute-force, and rainbow table attacks.
CO4	Make use of web application security testing techniques to identify and exploit vulnerabilities such as SQL Injection, Cross-site Scripting (XSS), and Command Injection
CO5	Analyze wireless and network-based attack techniques including weaknesses in WEP, WPA, and WPA2 encryption protocols, and evaluate attack vectors
CO6	Analyze the legal and ethical aspects of cybersecurity by interpreting the Indian IT Act and international laws, evaluating responsible disclosure practices

Course Contents:

Unit 1: Introduction to Ethical Hacking Overview of Cybersecurity and Ethical Hacking, Types of Hackers: White Hat, Black Hat, Grey Hat, Phases of Ethical Hacking: Reconnaissance to Reporting, Legal and Ethical Issues in Hacking, Tools Used in Ethical Hacking, Setting Up a Lab: Virtual Machines, Kali Linux, etc.	[6]
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Unit 2: Footprinting, Scanning, and Enumeration Passive vs active footprinting (Whois, Shodan, Google hacking), Network scanning: Nmap, Zenmap, Enumeration: SNMP, SMB, NetBIOS, DNS, Identifying live systems, open ports, and services.	[6]
Unit 3: System Hacking and Malware Password cracking (dictionary, brute force, rainbow tables), Privilege escalation techniques (Windows & Linux), Malware types: viruses, worms, Trojans, ransomware, Anti-malware techniques and evasion basics.	[6]
Unit 4: Web Application Hacking OWASP Top 10 overview, SQL Injection, Cross-site scripting (XSS), Command Injection, Burp Suite basics, Security misconfigurations and testing.	[6]
Unit 5: Wireless and Network Attacks Wireless encryption (WEP/WPA/WPA2), Packet sniffing and spoofing, MITM attacks, ARP poisoning, DNS spoofing.	[6]
Unit 6: Reporting, Laws, and Cyber Ethics Indian IT Act and global cyber laws, Reporting vulnerabilities: responsible disclosure Documentation of penetration tests, Security assessments, compliance (ISO 27001 overview).	[6]
Reference Books: - 1. CEH v11 Certified Ethical Hacker Study Guide – Wiley 2. Penetration Testing – Georgia Weidman 3. The Web Application Hacker's Handbook – Dafydd Stuttard 4. Hacking: The Art of Exploitation – Jon Erickson	




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Program Elective Course-III

23CS3605D	PEC	Soft Computing	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA-I:10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

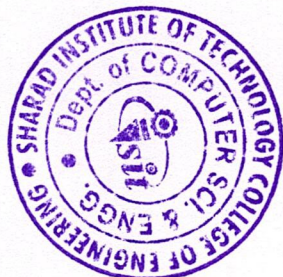
Pre-Requisites: - Basics of computer Networks

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain soft computing concepts and their differences from traditional (hard) computing.
CO2	Apply genetic algorithms for optimization problems, designing and evaluating GA operators.
CO3	Develop and implement fuzzy inference systems to handle uncertainty in engineering problems.
CO4	Analyze, design, and apply neural network models to classification and regression tasks.
CO5	Integrate soft computing methods to build hybrid intelligent systems with enhanced performance.
CO6	Compare advanced and swarm intelligence techniques for complex real-world applications.

Course Contents:

Unit 1: Introduction to Soft Computing Soft Computing: - definition, features, Examples, Hard Computing- definition, features, Examples and comparison, hybrid Computing, components (fuzzy logic, neural nets, GAs), real-world applications.	[6]
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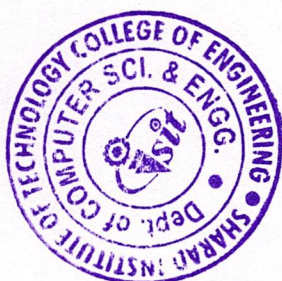

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Unit 2: Genetic Algorithms (GAs) Principle of genetic search, encoding schemes, selection, crossover, mutation, fitness evaluation, GA cycle, application in optimization	[6]
Unit 3: Fuzzy Logic and Fuzzy Systems Fuzzy sets, membership functions, fuzzy relations, operations, fuzzification/defuzzification, fuzzy inference systems, rule-based and control systems	[6]
Unit 4: Fundamentals of Neural Networks Biological vs. artificial neurons, activation functions, architectures (single & multi-layer), learning rules (Perceptron, Backpropagation), associative memory, SOM, ART	[6]
Unit 5: Hybrid Techniques (Neuro-Fuzzy, Neuro-Genetic) Neuro-fuzzy models (ANFIS), fuzzy-GA integration, GA-optimized BPN, neuro-genetic systems	[6]
Unit 6: Advanced Soft Computing & Swarm Intelligence Introduction to swarm based methods (Ant Colony, PSO, Cuckoo Search), multi-objective optimization, and applications.	[6]
Text Books: 1. Dilip K.Pratihar- Soft Computing Fundamentals and application Revised Edition Narosa Publication House. 2. J. -S.R.JANG, C.-T.SUM, E. MIZUTANI - Neuro- Fuzzy and Soft Computing-A Computational Approach To Learning & Machine Intelligence.	




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23CS3606	PCC	Machine Learning Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I:15 Marks CA II:15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Statistics, data science.

Course Outcomes: At the end of the course, students will be able to:

CO1	Make use of supervised learning algorithms to build Machine Learning Models.
CO2	Build Machine Learning Model using clustering technique.
CO3	Design a recommendation system by extracting and analyzing item features.
CO4	Design and implement a simple neural network using backpropagation for classification tasks.

Experiment List:

1. Develop Machine Learning model using Linear Regression.
2. Develop Machine Learning model using Decision Tree.
3. Develop Machine Learning model using K-Nearest Neighbor.
4. Build Machine Learning classifier using Logistic Regression.
5. Develop Machine Learning model using Support Vector Machine.
6. Construct a Machine Learning Model using the Naïve Bayes Algorithm.
7. Use K-Means Algorithm for performing clustering task.
8. Develop a Recommendation system.
9. Develop a Machine Learning model using Ensemble Learning.
10. Build a simple neural network using backpropagation.




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23CS3607	PCC	Software Testing Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I:15 Marks CA II:15 Marks End Semester Exam:20 Marks

Pre-Requisites: Mini Project

Course Outcomes: At the end of the course, students will be able to:

CO1	Apply various software testing methods.
CO2	Prepare test cases for different types and levels of testing.
CO3	Prepare test plan for given applications.
CO4	Identify bugs to create defect report of given application.
CO5	Test software for performance measures using automated testing tools.

Experiment List:

- 1) Install and get familiar with tools like JUnit, Selenium, and TestNG.
- 2) Develop unit tests for Java classes using assertions and annotations.
- 3) Design and execute black box test cases using ECP and BVA.
- 4) Create test cases to achieve statement and branch coverage.
- 5) Perform mutation testing to determine test case effectiveness.
- 6) Implement top-down and bottom-up integration testing.
- 7) Develop test scripts for web applications using Selenium WebDriver.
- 8) Create decision tables and state transition diagrams for test case generation.
- 9) Conduct load testing and performance evaluation.
- 10) File and track bugs in a real-time environment.





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23CS3608	PCC	Internet of Things Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I:15 Marks CA II:15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Web technology.

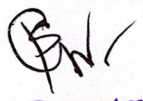
Course Outcomes: At the end of the course, students will be able to:

CO1	To explain the Raspberry pi and Arduino hardware.
CO2	To Install and configure Operating System on Raspberry pi and Arduino.
CO3	To Design and develop an application on different hardware/Board.
CO4	To Design and develop an IoT application on different hardware/Board

Experiment List:

1. Study of Raspberry pi and Arduino hardware.
2. Installation of Operating System on Raspberry pi.
3. LED Interfacing with Arduino.
4. LED Interfacing with Raspberry Pi.
5. LCD Interfacing with Arduino.
6. LCD Interfacing with Raspberry Pi.
7. Understanding the connectivity of Raspberry-Pi circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
8. Write an application using Raspberry-Pi to control the operation of a hardware simulated traffic signal.
9. Write an application using Raspberry-Pi to control the operation of a hardware simulated lift elevator.
10. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.




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23CS3609	PROJ	Mega Project Phase-I	0-0-4	2 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 4 hrs/week	CA I: 25 Marks CA II: 25 Marks End Semester Examination: 50 Marks

Pre-Requisites: All courses

Course Outcomes: At the end of the course, students will be able to:

CO1	State the exact title of the project and problem definition.
CO2	Explain the motivation, objectives and scope of the project.
CO3	Review the literature related to the selected topic of the project.
CO4	Design the mechanism, components of the system and prepare detailed drawings.
CO5	Evaluate the cost considering different materials/manufacturing processes.




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The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work, the submission of the report and assessment should be done at the end of VII Sem.

The project work should consist of any of the following or appropriate combination:

1. A comprehensive and up-to-date survey of literature related to study of a phenomenon or product.
2. Design of any equipment and / or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing the same.
4. Experimental verification of principles used in applications related to various specializations related to Mechanical Engineering.
5. Software development for particular applications.
6. A combination of the above.

It is expected that the students should complete at least 50% of the total project work in VI Semester. The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking and working and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of VII semester. The report shall be comprehensive and presented typed on A4 size sheets and bound. Number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.




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Multidisciplinary Minor-IV

23CSMDA4	MDM	Crop Modelling and Prediction	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

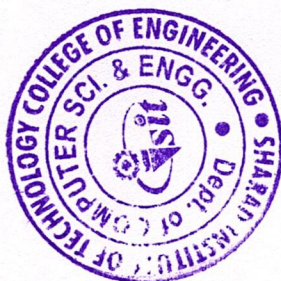
Pre-Requisites: Python, Data Science and visualization

Course Outcomes: At the end of the course, students will be able to:

CO1	Relate the role of data science in precision agriculture.
CO2	Outline how to collect, preprocess, and analyze agricultural datasets.
CO3	Explain IoT and remote sensing applications for smart farming.
CO4	Develop AI-based decision support systems for agriculture automation.

Course Contents:

Unit 1: Introduction to Crop Modelling Basics of Crop Growth and Development, Concept and Need for Crop Modelling, Types of Crop Models: Empirical, Mechanistic, and Simulation Models, Components of a Crop Model, Historical Evolution of Crop Modelling, Applications and Limitations of Crop Models.	[6]
Unit 2: Plant-Environment Interactions Soil-Plant-Atmosphere Continuum, Radiation Interception and Photosynthesis Models, Water Balance and Evapotranspiration Modelling, Nutrient Uptake and Growth Modelling, Impact of Weather and Climate Variables on Crop Growth, Climate Change Scenarios and Crop Response.	[6]
Unit 3: Crop Modelling Tools and Frameworks Overview of Popular Crop Models (DSSAT, APSIM, WOFOST, AquaCrop), Data Requirements for Crop Modelling, Calibration and Validation of Models, Sensitivity and Uncertainty Analysis, Introduction to Simulation Environments and User Interfaces, Case Studies using Crop Models.	[6]





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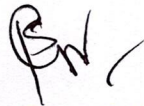
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Unit 4: Prediction Techniques in Agriculture Basics of Statistical Modelling for Crop Prediction, Time Series Analysis for Yield Prediction, Machine Learning Methods in Crop Prediction, Weather-Based Yield Forecasting Models, Remote Sensing Data Integration for Prediction, Crop Yield Estimation and Forecasting Case Studies	[6]
Unit 5: Decision Support Systems and Policy Applications Role of Decision Support Systems (DSS) in Agriculture, Model-Driven Decision Making for Irrigation and Fertilization, Risk Analysis and Management using Models, Early Warning Systems and Pest/Disease Prediction Models, Model Integration with GIS and ICT Tools, Policy Planning and Crop Insurance using Predictive Models.	[6]
Unit 6: Advances in Crop Modelling Big Data and IoT in Crop Modelling, Edge Computing and Real-Time Prediction Systems, Cloud-Based Modelling Platforms and APIs, Modeling for Precision Agriculture and Smart Farming, Open-source Tools and Open Data for Modelling, Ethics, Sustainability, and Future Trends in Crop Modelling	[6]
Textbooks: 1. Crop Simulation Models: Applications in Agricultural Research, R. S. Singh, R. S. Rattan, and P. S. 2. Agricultural Systems Modeling and Simulation, Robert M. Peart, R. Bruce Curry	




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Multidisciplinary Minor-IV

23CSMDB4	MDM	Engineering Economics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of Management

Course Outcomes: At the end of the course, students will be able to:

CO1	Recall and define the fundamental principles and scope of Engineering Economics.
CO2	Interpret and explain the concept of time value of money and its applications in financial analysis.
CO3	Apply cost estimation methods and conduct break-even analysis for engineering decision-making.
CO4	Analyze the impact of depreciation, inflation, and taxation on engineering economic decisions.
CO5	Assess capital investment alternatives and evaluate projects using capital budgeting techniques.
CO6	Design and develop capital budgeting models to support investment decisions and optimize project outcomes.

Course Contents:

Unit 1: Introduction to Engineering Economics Definition, Nature, and Scope of Engineering Economics, Importance in Engineering Decision-Making, Phases in Engineering Economic Analysis, Microeconomics vs. Macroeconomics in Engineering Context, Demand and Supply Analysis, Elasticity, Forecasting Techniques and Cost Terminology, Economic Environment and its Impact on Engineering Projects.	[6]
Unit 2: Time Value of Money and Financial Analysis Concept of Time Value of Money: Present and Future Value, Interest Formulas: Simple and Compound Interest, Annuities and Perpetuities, Cash Flow Diagrams and Economic Equivalence, Methods of Economic Analysis: NPV, IRR, Payback Period, Benefit-Cost Ratio, Comparison of Risk Analysis and Decision-Making under Uncertainty.	[6]



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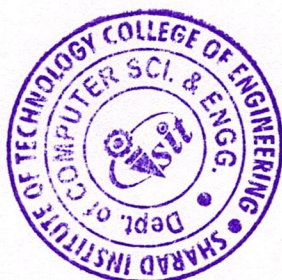
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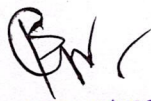
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Unit 3: Cost Concepts and Break-Even Analysis- Types of Costs: Fixed, Variable, Marginal, Average, Sunk, Opportunity Costs, Cost-Volume-Profit (CVP) Analysis, Break-Even Point (BEP) and its Applications, Cost Estimation Techniques and Cost Control, Learning Curve and its Impact on Cost Estimation, Value Engineering and Analysis.	[6]
Unit 4: Depreciation, Inflation, and Tax Considerations Depreciation: Meaning, Causes, and Methods (Straight Line, Declining Balance, Sum-of-Years-Digits), Depletion and Amortization, Impact of Inflation on Economic Analysis, Price Indices and Inflation Adjustment Techniques, Taxation: Income Tax Principles, Effective Tax Rates, After-Tax Economic Analysis and its Implications	[6]
Unit 5: Capital Budgeting and Project Evaluation Capital Budgeting Process and Techniques, Project Life Cycle Costing and Management, Cash Flow Analysis for Projects, Cost-Benefit Analysis and Cost-Effectiveness Analysis, Evaluation of Public and Private Sector Projects, Sensitivity Analysis and Scenario Planning.	[6]
Unit 6: Advanced Engineering Economics Economic Order Quantity (EOQ) and Inventory Management, Decision Analysis under Risk and Uncertainty, Expected Value and Variance in Decision-Making, Utility Theory and Risk Preferences, Game Theory Applications in Engineering Economics.	[6]
Textbooks: 1. Engineering Economy – Leland Blank & Anthony Tarquin 2. Engineering Economics – R. Panneerselvam 3. Principles of Engineering Economic Analysis – John A. White, Kenneth E. Case, David B. Pratt 4. Engineering Economic Analysis – Donald G. Newnan, Ted Eschenbach, Jerome P. Lavell	




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Multidisciplinary Minor-IV

23CSMDC4	MDM	Health Care Cyber security and Privacy	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA I: 10 Marks CA II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of Healthcare

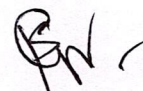
Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the need for cybersecurity in healthcare and identify common threats and challenges.
CO2	Apply privacy protection techniques and explain legal standards like HIPAA and GDPR.
CO3	Demonstrate the use of cryptography and secure communication in healthcare systems.
CO4	Analyze security vulnerabilities in healthcare IT infrastructure and propose mitigation strategies.
CO5	Design governance policies and incident response frameworks for healthcare cybersecurity.
CO6	Evaluate emerging technologies and address ethical and legal issues in health data security.

Course Contents:

Unit 1: Introduction to Healthcare Cybersecurity Importance of cybersecurity in healthcare, Key concepts: confidentiality, integrity, availability (CIA Triad), Common cyber threats: malware, ransomware, phishing, DDoS, insider threats, Historical breaches in healthcare and their impacts, Overview of regulatory standards: HIPAA, GDPR, Indian IT Act.	[6]
Unit 2: Health Data Protection and Privacy Types of sensitive health data (EHR, genetic, insurance, telemedicine), Data anonymization and pseudonymization techniques, Role-based access control (RBAC) in healthcare, Consent management and patient privacy rights, Secure handling of telemedicine and remote monitoring data.	[6]




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Unit 3: Cryptography and Secure Communication Basics of cryptography (symmetric and asymmetric encryption), Secure communication protocols: TLS, HTTPS, VPNs, Digital signatures, certificates, and public key infrastructure (PKI), End-to-end encryption in telehealth systems, Blockchain for health data integrity.	[6]
Unit 4: Network and Endpoint security in healthCare System Healthcare IT infrastructure vulnerabilities, Firewalls, IDS/IPS, antivirus systems, Securing medical IoT devices and remote patient monitoring systems, Risk assessment and penetration testing for hospital networks, Securing cloud platforms in healthcare.	[6]
Unit 5: Security Governance, Compliance, and Incident Response Security policies and procedures in hospitals, Risk management frameworks (NIST, ISO 27001), Incident detection, response, and recovery in healthcare, Auditing and compliance checks, Business continuity and disaster recovery planning.	[6]
Unit 6: Emerging Trends and Ethical Challenges AI and ML in healthcare cybersecurity, Cybersecurity challenges in wearable and mobile health apps, Legal and ethical dilemmas: surveillance vs. privacy, Future technologies: biometric authentication, zero trust architecture, Case studies on healthcare cyber incidents and lessons learned	[6]
Textbooks: 1. Engineering Economy – Leland Blank & Anthony Tarquin 2. Engineering Economics – R. Panneerselvam 3. Principles of Engineering Economic Analysis – John A. White, Kenneth E. Case, David B. Pratt 4. Engineering Economic Analysis – Donald G. Newnan, Ted Eschenbach, Jerome P. Lavell	




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23HSSM07	VEC	Aptitude Skills-IV	1-0-0	Audit
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Teaching Scheme	Evaluation Scheme
Lecture: 1 hr/week	CA I: 25 Marks CA II: 25 Marks

Pre-Requisites: Communication Skills, Aptitude Skills I, II

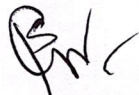
Course Outcomes: At the end of the course students will be able to:

CO1	Solve the questions on ordering of words & Parts of Speech
CO2	Organize contents of Business Communications such as CV, emails and letters.
CO3	Solve the questions based on jumbled paragraphs and reading comprehension.
CO4	Solve the questions on spotting error and sentence correction.
CO5	Summarize proceedings of any event or conference.
CO6	Discuss about current and critical issues during group discussion.

Course Contents:

Unit 1: Parts of Speech, Punctuation	[2]
Unit 2: Word Family (Using the same word as different Parts of Speech)	[2]
Unit 3: Analogy, Letter Writing (Formal), E-Mail Writing, CV Writing	[2]
Unit 4: Reading Comprehension, Paragraph Jumbles	[2]
Unit 5: One Word Substitution, Narrating Events/Reports, Summary/Precis Writing	[2]
Unit 6: Dialogue writing Group Discussion, Interview Skills (Using formal notations & gestures etc.)	[2]




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Text Books:

1. Raymond Murphy, Essential English Grammar with Answers, Murphy.
2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)

Reference Books:

1. Rao and ,D,V,Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017.
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press; Second edition




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23HSSM08	VEC	Language Skills-IV	0-0-2	Audit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I: 25 Marks CA II: 25 Marks

Pre-Requisites: Language Skills I, II, III

Course Outcomes: At the end of the course students will be able to:

CO1	Make use of Function in Python Programming.
CO2	Make use of Python collections.
CO3	Make use of classes and its objects in python.
CO4	Make use of file and it's handling functions.

Course Contents:

1. Write a Python program to define a user-defined function that takes a number as input and returns whether it is even or odd. Call the function and display the result.	[2]
2. Create a Python program to define and call a function with default arguments and keyword arguments.	[2]
3. Write a Python program using a lambda function to compute the square, cube, and factorial of a given number.	[2]
4. Write a Python program to demonstrate list operations such as creation, adding items, removing an item, slicing, and sorting.	[2]
5. Write a Python program to demonstrate the use of tuples and sets. Perform operations such as checking membership, adding/removing elements (set), and iterating.	[2]





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6. Write a Python program to create a dictionary of employees with their ID as key and name as value. Perform operations like adding a new entry, updating existing, and deleting one.	[2]
7. Write a Python program to create a class Student with attributes name, roll_no, and a method display(). Create an object and access its members.	[2]
8. Create a class with an __init__() constructor to initialize data members and a destructor to display a message when the object is deleted.	[2]
9. Write a program to demonstrate single inheritance where a class Vehicle is inherited by a class Car. Use super() to access base class methods.	[2]
10. Write a Python program to open a text file in write mode and write your personal information (name, age, department). Then, read and display the content of the file.	[2]
11. Write a program to read a file line by line using readline() and count the number of characters in each line.	[2]




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23CS3610	MC	Constitution of India	1-0-0	Audit
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Teaching Scheme	Evaluation Scheme
Lecture: 1 hrs/week	CA-I:25 Marks CA-II: 25 Marks

Pre-Requisites: Nil

Course Outcomes: At the end of the course, students will be able to:

CO1	Define the meaning and features of Indian constitution.
CO2	Interpret right to life and fundamental rights to certain freedom under article 19 and 21.
CO3	Outline the federal structure of power and directive principles of state policy.

Course Contents:

Unit 1: Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India.	[2]
Unit 2: Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights, The scheme of the Fundamental Duties and its legal status.	[2]
Unit 3: The Directive Principles of State Policy – Its importance and implementation, Federal structure and distribution of legislative and financial powers between the Union and the States, Parliamentary Form of Government in India – The constitution powers and status of the President of India.	[2]
Unit 4: Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency.	[2]
Unit 5: Local Self Government – Constitutional Scheme in India , Scheme of the Fundamental Right to Equality.	[2]
Unit 6: Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.	[2]
Text Books: 1. Constitution of India Published by Government of India Ministry of Law and Justice (Legislative Department), 2020. 2. Textbook on The Constitution of India by S R Bhansali Constitution of India by Bakshi P M, January 2014.	

