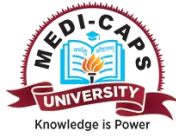


# **Department of Computer Science and Engineering**

## **CURRICULUM AND SYLLABUS**

**(2024-2026)**

**M.Tech. Computer Science and Engineering**

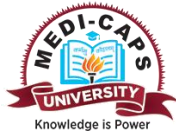


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# Computer Science and Engineering

**M.Tech. (CSE)**

**CURRICULUM AND SYLLABUS**



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### **Vision Statement of University**

Be an internationally acclaimed University recognised for its excellent teaching, research, innovation, outreach and creating top class technocrats and professionals who can serve the mankind as multi skilled global citizen.

### **Mission Statement of University**

- Establish state-of-the-art facilities for world class education and research.
- Conduct scholarly research and creative endeavours that impact quality of life.
- Attract quality staff and students to cater for diverse needs and preferences and widen participation.
- Build a foundation for students to be successful at all levels through high-quality, innovative programs.
- Collaborate with institute, industry, and society to address current issues through research and align curriculum.
- Involve in societal outreach programs to identify concerns and provide sustainable ethical solutions.
- Encourage life-long learning and team-based problem solving through an enabling environment.

### **Vision of the Department:**

Inculcate the innovative thinking in Computer Science and Engineering graduates with domain knowledge and skills to address contemporary industrial and social requirements.

### **Mission of the Department:**

1. Provide an environment to the students to learn with passion and equip with proper skill set to address current problems.
2. Provide maximum exposure to innovative techniques available to cater industrial needs by maintain the best Industry- Academia relation.
3. Imparting best problem-solving strategies in students to work in a team.
4. Develop leadership qualities in Computer Science graduates to work for the society.
5. Attract experienced and expert faculty members and create an enthusiastic academic environment.



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## Department of Computer Science and Engineering

### Program Education Objectives (PEOs)

- PEO<sub>01</sub>** Provide strong theoretical foundations to work with cutting edge computing technologies and design solutions to complex engineering problems to work in any competitive environments.
- PEO<sub>02</sub>** Impart skills such as team building, inter-personal skills, and leadership qualities in order to effectively communicate with engineering community and with society at large.
- PEO<sub>03</sub>** Promote research culture through internships, industry trainings, research-oriented projects, sponsored collaborative research and enable them to pursue higher studies in computer and related fields.
- PEO<sub>04</sub>** Create ethically strong, professionally, and globally competent employees and entrepreneurs.

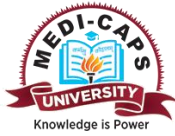


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## Department of Computer Science and Engineering

### PROGRAMME OUTCOMES (POs)

- PO<sub>01</sub> Engineering knowledge:** Apply the knowledge of mathematics, science, engineering, fundamentals, and an engineering specialization to the solution of
- PO<sub>02</sub> Problem analysis:** Identify, formulate, review, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- PO<sub>03</sub> Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO<sub>04</sub> Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO<sub>05</sub> Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO<sub>06</sub> The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO<sub>07</sub> Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO<sub>08</sub> Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO<sub>09</sub> Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.



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- PO<sub>10</sub> Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO<sub>11</sub> Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO<sub>12</sub> Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



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## Department of Computer Science and Engineering

### **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

- PSO<sub>01</sub>** Ability to understand the principles and working of computer systems and a good knowledge about the hardware and software aspects of computer systems.
- PSO<sub>02</sub>** Ability to work in multidisciplinary teams in small- and large-scale projects by utilizing modern software engineering tools and emerging technologies.
- PSO<sub>03</sub>** Ability to design and develop computer programs and understand the structure and development methodologies of software systems.
- PSO<sub>04</sub>** Ability to apply their skills in the field of the specialization AI, Data Science, Web Technology, Networking and Cloud Computing web design, cloud computing and data analytics.



**M.Tech CSE- Batch 2024**  
**(Specialization in Artificial Intelligence)**

**SEMESTER I**

Sr.No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CS5BS02	Statistics	4	0	0	4	4
2	CS5AI04	Artificial Intelligence	4	0	4	8	6
3	CS5PC03	Minor Project-I	0	0	16	16	8
4	EN5RD01	Research Methodology	4	0	0	4	4
Total			12	0	20	32	22

**SEMESTER II**

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CS5EL24	Data Science	4	0	4	8	6
2	CS5AI05	Natural Language Processing	4	0	0	4	4
3	CS5EL22	Neural Networks	4	0	0	4	4
4	CS5PC04	Minor Project-II	0	0	16	16	8
Total			12	0	20	32	22

**SEMESTER – III**

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CS5AI02	Machine Learning	4	0	4	8	6
2	CS5EL25	Internet of Things	4	0	0	4	4
3	EN5HS02	Technical Paper writing	0	0	2	2	1
4	EN5MC01	Value and Ethics	2	0	0	2	0
5	CS5PC05	Dissertation Phase-I	0	0	0	20	10
Total			10	0	6	36	21

**SEMESTER-IV**

Sr. No	Course Code	Courses	L	T	P	Hrs.	Credits
1	CS5AI06	Digital Image Processing	4	0	4	8	6
2	EN5HS01	Entrepreneurship and Management	3	0	0	3	3
3	CS5PC06	Dissertation Phase-II	0	0	0	32	16
Total			7	0	4	43	25





**SEMESTER I**

<b>Sr.No</b>	<b>Course Code</b>	<b>Courses</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Hrs.</b>	<b>Credits</b>
1	CS5BS02	Statistics	4	0	0	4	4
2	CS5AI04	Artificial Intelligence	4	0	4	8	6
3	CS5PC03	Minor Project-I	0	0	16	16	8
4	EN5RD01	Research Methodology	4	0	0	4	4
Total			12	0	20	32	22

**MEDI-CAPS**

Subject Code	Subject Name	Hours per Week			Total	Total
		Lecture	Tutorial	Practical	Cr	Credit
CS5BS02	STATISTICS	4	0	0	4	4

### Unit-I: Introduction to Statistics

Importance of statistics, concepts of statistical population and a sample, Concepts of population parameter and sample statistic, quantitative and qualitative data - collection of primary and secondary data. Classification and tabulation of data. Measurement scales: nominal, ordinal, interval and ratio, Construction of univariate and bivariate frequency distributions.

### UNIT-II: Estimation Theory and Testing of Hypothesis

Estimation Theory: Unbiasedness, Consistency, efficiency and sufficiency of estimations, Maximum likelihood estimates and their properties (without proof). Testing of Hypothesis: Simple and composite hypothesis, Errors of kind-I and kind –II, critical region, level of significance, size and power of a test.

### UNIT-III: Test of Significance

Test of simple hypothesis, Chi-square test, goodness of fit, independence of attributes in contingency table and equality of many proportions, t-test, F-test and problems based on them, Application of test of significance in Data Mining.

### UNIT-IV: Correlation and Regression

Correlation: Introduction, Types, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation Coefficient, Multiple and Partial Correlation. Regression: Linear regression, regression coefficients, Concept of Multiple Linear Regression and Matrix Notation of Multiple Linear Regression.

### UNIT-V: Non Parametric Tests

Need for non parametric tests, Sign test for one sample and two samples, Wilcoxon signed rank test, Median test, Wald Wolfowitz run test, Mann Whitney U test, Run test for randomness, test for independence based on Spearman's rank correlation coefficient (small and large samples), Kruskal Wallis Test for equality of several means. Applications of Non parametric Tests in Data Mining.

### Text Books

1. Gupta. S.C, Kapoor V.K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Freund J.E., Mathematical Statistics, Prentice Hall.
3. Cochran, W. G: Sampling Techniques, Wiley Eastern.

### References:

1. Montgomery D. C., Introduction to Statistical Quality Control. Wiley International edition.
2. K. S. Krishnamurthy, Reliability Methods for Engineers, ASQ Press
3. Berenson and Levine, Basic Business Statistics, Prentice- Hall India.
4. Daniel and Terrell Business Statistics for Management and Economics, Prentice- Hall India.
5. Ross Sheldon, A First Course in Probability, Macmillan.



Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
CS5AI04	Artificial Intelligence	4	0	4	8	6

### Unit 1

**Introduction, Overview of Artificial intelligence:** Problems of AI, AI technique, Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, expert system, problem characteristics.

### UNIT 2:

**Search techniques:** Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A\* search, AO\* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

### Unit 3

**Constraint satisfaction problems:** Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

### Unit 4

**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

### Unit 5

**Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.



**Text Book:**

1. Elaine Rich, Kevin Knight and Nair, Artificial Intelligence, TMH
2. S. Russel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson.

**Reference Books:**

1. Saroj Kausik, Artificial Intelligence, Cengage Learning 4
2. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press,
3. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann.
4. David Poole, Alan Mackworth, Artificial Intelligence: Foundations for Computational Agents, Cambridge Univ. Press..



Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hr	Credit
EN5RD01	<b>Research Methodology</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>

**Unit-I: Introduction to Research Techniques**

Meaning of research, objectives of research, motivation in research, types of research- empirical and experimental research, algorithmic research, simulation research, mathematical modelling approach, characteristics and prerequisites of research, significance of research, research process, Sources of research problem, criteria of identifying the problem, necessity of defining the problem, formulation of a research problem, errors in selecting research problem, technique involved in defining the problem, Report and paper writing.

**Unit-II: Statistical analysis**

Statistical analysis, Measures of central tendency and dispersion, mean, median, mode, range, mean and standard deviations, computing correlation in variables, linear and non-linear regression.

**Unit-III: Probability and Probability distributions**

*Probability:* classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence. Probability distributions: binomial, poisson, geometric, negative binomial uniform exponential, normal and log normal distribution.

*Random Variables:* Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quintiles, Markov inequality, correlation and regression, independence of random variables.

**Unit-IV: Sampling & Distributions**

The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, ChiSquare, t and F distributions, problems. Hypothesis Testing: Basic ideas of testing hypothesis, null and alternative hypotheses, the critical and acceptance regions, two types of error, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications. Software and Tools to be learnt: Statistical packages like SPSS and R.

**Unit-V: Simulation and Soft Computing Techniques**

Introduction to soft computing, Artificial neural network, Genetic algorithm, Fuzzy logic and their applications, Tools of soft computing, Need for simulation, types of simulation, simulation language, fitting the problem to simulation study, simulation models, verification of simulation models, calibration and validation of models, Output analysis. Introduction to any one simulation tool e.g. MATLAB, NS2, ANSYS, Cadence etc. (Department Specific).

**Text Books:**

1. R. Panneerselvam, Research Methodologies, PHI.
2. C.R. Kothari: Research methodology, Methods and Techniques, New Age Publication.
3. S.M. Ross, A First Course in Probability, Prentice Hall.

**References:**

1. Best John V. and James V Kahn: Research in Education, Wiley eastern.
2. S.P. Sukhia, P.V. Mehrotra, and R.N. Mehrotra: Elements of Educational Research, PHI publication.
3. K. Setia, Methodology of Research Education, IEEE publication.
4. Jerry Banks, John S. Carson, Barry.L. Nelson David. M. Nicol, Discrete-Event System Simulation, Prentice-Hall India.
5. V.K. Rohatgi, A.K. Md.E.Saleh, An Introduction to Probability and Statistics, John Willey.



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**SEMESTER II**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Courses</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Hrs.</b>	<b>Credits</b>
1	CS5EL24	Data Science	4	0	4	8	6
2	CS5AI05	Natural Language Processing	4	0	0	4	4
3	CS5EL22	Neural Networks	4	0	0	4	4
4	CS5PC04	Minor Project-II	0	0	16	16	8
Total			12	0	20	32	22



Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CS5EL24	Data Science	4	0	4	6

**Unit-1**

Database Management: Relational Databases, NoSQL Databases, Database Design and Implementation.

**Unit-2**

Data Mining and Pattern Recognition: Association Rule Mining, Clustering Algorithms, Classification Algorithms

**Unit-3**

Foundations of Data Science: Probability and Statistics, Linear Algebra, Mathematical Optimization Data Manipulation and Analysis: Data Cleaning and Preprocessing, Exploratory Data Analysis (EDA), Data Visualization.

**Unit-4**

Machine Learning: Supervised Learning (Regression, Classification), Unsupervised Learning (Clustering, Dimensionality Reduction), Ensemble Methods, Deep Learning, Introduction to Big Data Technologies.

**Unit-5**

Advanced Analytics and Predictive Modeling: Time Series Analysis, Advanced Predictive Modeling, Data Ethics and Privacy: Ethical considerations in Data Science, Privacy and Security issues.

**LAB**

**Capstone Project:**

Applied Data Science Project  
Real-world Problem Solving

**Text Book:**

1. "Python for Data Analysis" by Wes McKinney, Publisher: O'Reilly Media
2. "The Elements of Statistical Learning" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Publisher: Springer
3. "Data Science from Scratch" by Joel Grus, Publisher: O'Reilly Media

**Reference Book:**

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Publisher: MIT Press
2. "R for Data Science" by Hadley Wickham and Garrett Golemund, Publisher: O'Reilly Media



Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CS5EL22	Neural Networks	4	0	0	4

### Unit 1

Introduction to Neural Networks: Overview of Artificial Neural Networks (ANNs), Biological inspiration and history of neural networks, Perceptrons and McCulloch-Pitts model, Activation functions and their properties, Single-layer perceptrons (SLPs) and multilayer perceptrons (MLPs).

### Unit 2

Neural Network Architectures: Feedforward and feedback neural networks, Radial Basis Function (RBF) networks, Self-organizing maps (SOMs), Recurrent neural networks (RNNs), Long Short-Term Memory (LSTM) networks, Convolutional Neural Networks (CNNs).

### Unit 3

Learning in Neural Networks: Supervised learning: Backpropagation algorithm, Unsupervised learning: Hebbian learning, Kohonen networks, Reinforcement learning in neural networks, Transfer learning and fine-tuning, Regularization techniques (dropout, weight decay).

### Unit 4

Applications of Neural Networks: Image and pattern recognition, Natural language processing, Speech recognition, Time series analysis and prediction, Autonomous systems and robotics, Neural network applications in computer vision.

### Unit 5

Advanced Topics and Recent Developments: Generative Adversarial Networks (GANs), Explainable AI and interpretability in neural networks, Attention mechanisms, Neural network optimization techniques, Ethical considerations in AI and neural networks, Current trends and research directions in neural networks.

### Text Book:

1. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal, Publisher: Springer
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Publisher: MIT Press
3. "Neural Networks: A Comprehensive Foundation" by Simon Haykin, Publisher: Prentice Hall

### Reference Books:

1. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili, Publisher: Packt Publishing
2. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani
3. "Neural Networks and Learning Machines" by Simon S. Haykin, Publisher: Pearson





Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CS5AI05	Natural Language Processing	4	0	0	4

### **Unit 1: Introduction**

Natural Language Processing - Problems and perspectives, The evaluation of NLP applications, Computational Morphology, Tokenization , Corpora and their construction ,use of regular expressions in NLP.

### **Unit 2: Language and Grammar Models**

Introduction to probability calculus, N-grams and Language Models, Markov Models ,Introduction to Machine Learning and Deep Learning models, Recurrent Neural Network Language Models, Introduction to CFG and P-CFG.

### **Unit 3: Computational Semantics**

POS tagging, Lexical semantics: WordNet and FrameNet, Word Sense Disambiguation, Distributional Semantics & Word-Space models ,Word/Sentence/Text embeddings.

### **Unit 4: Computational Phonetics and Speech Processing**

Speech samples: properties and acoustic measures, Analysis in the frequency domain, Spectrograms, Applications in the acoustic phonetic field, Speech recognition with HMM and Deep Neural Networks.

### **Unit 5: Applications and Case studies:**

Solving Downstream Tasks: Document classification, Sentiment Analysis, Named Entity Recognition, Semantic Textual Similarity, Prompting Pre-Trained Language Models, Introduction to Transformers BERT and GPT.

### **Text Books:**

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, Pearson Education.
2. James Allen, “Natural Language Understanding”, Pearson Education.

### **Reference Books:**

1. Christopher D. Manning and Hinrich Schutze, “Foundation of statistical Natural Language Processing”, MIT Press.
2. Mary Dee Harris “Introduction to Natural language Processing” ,Reston



**SEMESTER – III**

Sr. No.	Course Code	Courses	L	T	P	Hrs.	Credits
1	CS5AI02	Machine Learning	4	0	4	8	6
2	CS5EL25	Internet of Things	4	0	0	4	4
3	EN5HS02	Technical Paper writing	0	0	2	2	1
4	EN5MC01	Value and Ethics	2	0	0	2	0
5	CS5PC05	Dissertation Phase-I	0	0	0	20	10
Total			10	0	6	36	21



Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CS5AI02	Machine Learning	4	0	4	6

### Course Learning Objectives (CLOs):

- CLO01** Gain a comprehensive understanding of the fundamental concepts and types of machines learning algorithms, including supervised, unsupervised, and reinforcement learning.
- CLO02** Develop proficiency in implementing and applying supervised learning algorithms, such as k-Nearest Neighbours (KNN), linear regression, logistic regression, and decision trees.
- CLO03** Explore and apply unsupervised learning algorithms, including clustering, dimensionality reduction, and anomaly detection, to analyse and interpret complex datasets.
- CLO04** Understand the importance of data visualization in machine learning and its role in exploratory data analysis.
- CLO05** Familiarize yourself with advanced topics in machine learning, such as ensemble learning, support vector machines (SVM), reinforcement learning, and natural language processing (NLP).

### Unit 1: Introduction to Machine Learning

Overview of machine learning: Definition, goals, and applications. Types of machine learning: Supervised learning, unsupervised learning, reinforcement learning. Key concepts: Features, labels, training data, testing data, model, prediction, evaluation metrics.

### Unit 2: Supervised Learning Algorithms

k-Nearest Neighbors (KNN): Distance metrics, choosing k, majority voting. Linear regression: Assumptions, cost function, gradient descent. Logistic regression: Sigmoid function, binary classification, multi-class classification. Decision trees: Construction, entropy, information gain.

### Unit 3: Unsupervised Learning Algorithms

Clustering: K-means clustering, hierarchical clustering, evaluation metrics. Dimensionality reduction: Principal Component Analysis (PCA), Singular Value Decomposition (SVD). Anomaly detection: Gaussian distribution, outlier detection.

### Unit 4: Introduction to Data Visualization in Machine Learning

Importance and benefits of data visualization in machine learning, Visualization-driven exploratory data analysis, Visualization Tools and Libraries for Machine Learning (e.g., Matplotlib, Seaborn), Visualizing Data Distributions and Relationships (Scatter plots, histograms, box plots, pair plots, heatmaps, correlation matrices etc.)



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## **Unit 5: Advanced Topics in Machine Learning**

Ensemble learning: Bagging, boosting, random forests. Support Vector Machines (SVM): Kernel methods. Reinforcement learning: Markov decision processes. Natural Language Processing (NLP): Word embeddings, text classification, sentiment analysis.

### **Course Outcomes (COs):**

**After completion of this course the students shall be able to:**

- CO01** Proficiency in implementing and applying supervised learning algorithms to solve classification and regression problems.
- CO02** Competence in utilizing unsupervised learning techniques to uncover patterns and structures in data, facilitating data exploration and knowledge discovery.
- CO03** Understanding of advanced machine learning concepts and algorithms, enabling the application of ensemble learning, support vector machines, reinforcement learning, and NLP to solve complex problems.
- CO04** Ability to effectively visualize and analyse data using appropriate visualization tools and techniques in the context of machine learning.
- CO05** Capability to critically evaluate and select appropriate machine learning algorithms for different real-world scenarios and interpret and communicate the results effectively.



Course Code	Course Name	Hours Per Week			
		L	T	P	Credits
CS5EL25	Internet of Things	4	0	0	4

### Course Learning Objectives (CLOs):

- CLO01** Understand the fundamentals and architecture of IoT.
- CLO02** Explore various IoT communication technologies and protocols.
- CLO03** Design and implement IoT systems and applications.
- CLO04** Manage and analyze data generated by IoT devices.
- CLO05** Address security and privacy challenges in IoT systems.

### Unit 1: Introduction to IoT

**Introduction to IoT:** Definition and scope of IoT, History and evolution of IoT. **IoT Architecture:** Layers of IoT architecture and Components of IoT (sensors, actuators, devices). **IoT Applications:** Smart homes, Healthcare, Industrial IoT, Agriculture, Transportation. **Challenges and Future of IoT:** Technical challenges, Market trends and future directions.

### Unit 2: IoT Communication Technologies and Protocols

**Communication Technologies:** Wi-Fi, Bluetooth, Zigbee, LoRa, NB-IoT, Sigfox. **IoT Protocols:** MQTT, CoAP, HTTP, WebSockets and Comparison of protocols. **Network Architecture and Standards:** Network topologies and Standardization efforts in IoT. **Comparative Analysis of Communication Protocols:** Use cases and performance evaluation.

### Unit 3: IoT System Design and Development

**IoT System Design:** Hardware requirements, Software components and frameworks. **IoT Development Platforms:** Arduino, Raspberry Pi, ESP8266 and ESP32. **Sensor and Actuator Integration:** Interfacing sensors and actuators, Communication modules. **IoT Project Implementation:** Case studies and project examples and Hands-on development.

### Unit 4: Data Management and Analytics in IoT

**IoT Data Management:** Data storage solutions, Data retrieval and processing. **Data Analytics and Visualization Tools:** Tools for data analysis, Data visualization techniques. **AI in IoT:** Role of AI in IoT systems, machine learning for IoT data analysis, case studies of AI powered IoT applications. **Cloud Computing in IoT:** Cloud platforms for IoT, Data storage and processing in the cloud. **Case Studies on Data Management in IoT Applications:** Real-world examples of IoT data management.



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## Unit 5: IoT Security and Privacy

**IoT Security Challenges:** Threats and vulnerabilities, Security requirements. **Security Protocols and Measures for IoT:** Encryption and authentication, Secure communication protocols. **Privacy Issues in IoT:** Data privacy concerns, Privacy protection mechanisms. **Case Studies: IoT Security and Privacy Solutions:** Real-world examples of security and privacy in IoT.

### Text Books

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal," Internet of Things: Architecture and Design Principles", Tata McGraw Hill Publication.

### Reference Books

1. Ovidiu Vermesan, Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2013.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.

### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO<sub>01</sub> Describe the architecture and components of IoT.
- CO<sub>02</sub> Analyze and compare different IoT communication technologies and protocols.
- CO<sub>03</sub> Develop IoT applications using appropriate hardware and software tools.
- CO<sub>04</sub> Utilize data management techniques for IoT data.
- CO<sub>05</sub> Implement security measures for IoT systems to protect data and privacy.



Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hr	Credit
<b>EN5HS02</b>	<b>Technical Paper Writing</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>1</b>

- Report writing, various formats
- Plagiarism
- How to make a synopsis
- Reading techniques
- Making a hypothesis
- Writing abstract and Summary
- Paraphrasing
- Building thoughts
- Chapterization
- Formatting
- Oral presentation
- How to make good ppts
- Viva voce/ interviews
- Importance of syntax and semantics, Mechanics of writing, Proof reading

**Text Books:**

1. C.R Kothari. Research Methodology. Sultan Chand & Sons, New Delhi.
2. Day R A. How to Write and Publish a Scientific Paper. Cambridge University Press.
3. Sharma RC and Krishna Mohan, Business correspondence and report writing, Tata Mc Graw Hill.
4. Murphy Herta A, Herbert W Hildebrandt, Jane P Thomas. Effective Business Communication. Tata Mc Graw Hill.
5. Rizvi Ashraf. *Effective Technical Communication*. Tata Mc Graw Hill.
6. Koneru Aruna. Professional Communication, McGraw Hill.



Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hr	Credit
<b>EN5MC01</b>	<b>Value and Ethics</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**UNIT-I**

HUMAN VALUES :Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Character.

**UNIT-II**

ENGINEERING ETHICS: Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories. Valuing Time – Co-operation – Commitment –

**UNIT-III**

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

**UNIT-IV**

SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.

**UNIT-V**

GLOBAL ISSUES: Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-

**Text Books:**

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

**References :**

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Learning.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press.





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**SEMESTER-IV**

<b>Sr. No</b>	<b>Course Code</b>	<b>Courses</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Hrs.</b>	<b>Credits</b>
1	CS5AI06	Digital Image Processing	4	0	4	8	6
2	EN5HS01	Entrepreneurship and Management	3	0	0	3	3
3	CS5PC06	Dissertation Phase-II	0	0	0	32	16
Total			7	0	4	43	25



Subject Code	Subject Name	Hours per Week			Total	Total
		L	T	P	Hr	Credit
<b>EN5HS01</b>	<b>Entrepreneurship and Management</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**Course Objectives**

1. To Institute Entrepreneurship Skills in the Students
2. To inculcate the spirit and perspective of entrepreneurship among students
3. To make the students job creators instead of job seekers.
4. To enable the students to manage the business and organizations.
5. To use concepts of management, organization structure dynamics effectively to achieve organizational goals.

**Course Outcomes:**

On successful completion of this course students will have a better understanding on fundamentals of different business opportunities and strategies required to make it successful.

**Course Contents:**

**Unit-I: Introduction to Entrepreneurship**

Definition and Meaning, Concept and Need of Entrepreneurship; Role of entrepreneurship in Economic Development; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors, Managerial vs. entrepreneurial approach, Entrepreneur vs. Intrapreneur, Types of Entrepreneurs, Traits/Qualities of an Entrepreneurs, Characteristic of successful entrepreneurs, Entrepreneurship process, Women as Entrepreneurs, Ethics and Social Responsibilities; Entrepreneurial challenges.

**Unit-II: Creating and Starting the Venture**

Business plan– Meaning, Significance, contents, formulation and presentation of Business Plan, implementing business plans. Marketing plan, financial plan and the organizational plan, Launching Formalities, Common errors in Business Plan formulation.

**Unit: III- Innovation and Entrepreneurship**

Entrepreneurship and Innovation The Innovation Concept, Importance of Innovation for Entrepreneurship, Source of Innovation for Opportunities, The Innovation Process, Product life cycle, new product development process, Creativity and innovation in product modification/ development.

**Unit-IV: Introduction to Management and Organization**

Concept and differences between industry, commerce and business. Various types of ownership in the organization– Definition, Characteristics, Merits & Demerits, Single ownership, Partnership, Cooperative Organizations, Joint Stock Companies, Government owned. Difference between management and administration. Management as a science and as an art, different types of leadership models-Autocratic Leader, Democratic Leader, Free Rein Leader ,Freelance Leader.



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### **Unit–V:Functions of Management**

Planning: Definition, Types of Planning, Steps in planning process. Nature and Purpose of Organizing: Staffing, Line and Staff Relationship, Line-Staff Conflict, Directing: definition and importance, Controlling: Concept and Process of Control, Control Techniques, Control as a Feedback System,

#### **Text Books**

1. Rajeev Roy, Entrepreneurship, Oxford University press.
2. Stephen P. Robbins, David A. Decenzo, Sanghmitra Bhattacharya, Madhushree Nanda Agarwal, Fundamentals of Management, Pearson Education.
3. Robbins, Management, Pearson Education.
4. Harold Koontz, O'Donnell, Heinz Weihrich, Essentials of Management. Tata McGraw Hill.
5. Stoner, *Management*, PHI Learning.
6. Vasant Desai, Small scale Industries and Entrepreneurship, Himalaya Publishing House.
7. Gupta C.B. Khanks S.S., Entrepreneurship and Small Business Management, Sultan Chand & Sons, New Delhi.

#### **References**

1. Greene, Entrepreneurship, Cengage learning.
2. B. K. Mohanty Fundamentals of Entrepreneurship PHI.
3. Barringer, Entrepreneurship Pearson education.
4. Desai Vasant, Dynamics of Entrepreneurship Development and Management, Himalaya Publishing House
5. David H Holt Entrepreneurship: New Venture Creation, PHI.
6. Satyaraju, Parthsarthy, Management Text and Cases, PHI Learning.
7. Kanishka Bedi, Management and Enterpreneurship, Oxford Higher Education.