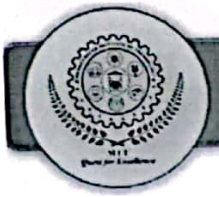

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An Autonomous Institute Affiliated to
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad, Maharashtra (India)

Third Year B. Tech. Syllabus (Artificial Intelligence and Data Science /Artificial Intelligence (AI) and Data Science) 2023-24

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T. Y. B. Tech. Syllabus Structure w.e.f. 2023-24 (Pattern 2021-22)

Artificial Intelligence and Data Science /Artificial Intelligence (AI) and Data Science

Semester-V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
			Orientation Programs (1 Day)											
1.1	HSMC	HSM301	Engineering Economics and Financial Management	3	-	-	3	3	15	15	10	10	50	100
1.2	PC	AID301	Data Engineering	3	-	-	3	3	15	15	10	10	50	100
1.3	PC	AID302	Design and Analysis of Algorithm	3	-	-	3	3	15	15	10	10	50	100
1.4	PC	AID303	Machine Learning	3	-	-	3	3	15	15	10	10	50	100
1.5	PC	AID304	Software Process and Project Management	3	-	-	3	3	15	15	10	10	50	100
1.6	PC	AID321	Lab-I: Data Engineering	-	-	2	2	1	-	-	-	25	-	25
1.7	PC	AID322	Lab-II: Design and Analysis of Algorithm	-	-	2	2	1	-	-	-	-	25	25
1.8	PC	AID323	Lab-III: Machine Learning	-	-	2	2	1	-	-	-	-	25	25
1.9	PRO	AID324	Lab-IV: Seminar	-	-	2	2	1	-	-	-	-	25	25
1.10	PRO	AID325	Lab-V: Experience-based learning	-	-	2	2	1	-	-	-	25	-	25
1.11	PC	AID326	Lab-VI: Development of Skills (Computational) UI/ UX Design	-	-	2	2	1	-	-	-	25	-	25
				15	0	12	27	21	75	75	50	125	325	650

Semester-VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
2.1	PC	AID351	Data Analytics and Modelling	3	-	-	3	3	15	15	10	10	50	100
2.2	PC	AID352	Artificial Neural Network and Deep Learning	3	-	-	3	3	15	15	10	10	50	100
2.3	PC	AID353	Operating System	3	-	-	3	3	15	15	10	10	50	100
2.4	PC	AID354	Dependable AI (Trustworthy AI System)	3	-	-	3	3	15	15	10	10	50	100
2.5	OE	AID391	Open Elective-III	3	-	-	3	3	15	15	10	10	50	100
2.6	PC	AID371	Lab-I: Data Analytics and Modelling	-	-	2	2	1	-	-	-	25	-	25
2.7	PC	AID372	Lab-II: Artificial Neural Network and Deep Learning	-	-	2	2	1	-	-	-	25	-	25
2.8	PC	AID373	Lab-III: Operating System	-	-	2	2	1	-	-	-	-	25	25
2.9	PC	AID374	Lab-IV: Visualization Tools	-	-	2	2	1	-	-	-	-	25	25
2.10	PRO	AID375	Lab-V: Major Project-I	-	-	4	4	2	-	-	-	25	25	50
				15	0	12	27	21	75	75	50	125	325	650

L-Lecture, T- Tutorial, P- Practical, MSE- Mid Semester Exam, CIE- Continuous In-semester Evaluation, TA-Teacher Assessment, ESE- End Semester Examination

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TY OPEN ELECTIVE-III (ALL)

DEPARTMENT OFFERED	COURSE CODE	COURSE TITLE
Agricultural Engineering	AED391	Fundamentals of Bioenergy
Civil Engineering	CED391	Solid Waste Management
Computer Science and Engineering	CSE391	RHCSA (RedHat Certified System Administration)
Computer Science and Engineering	CSE392	Digital Marketing
Electronics and Computer Engineering	ECE391	Data Science
Electronics and Computer Engineering	ECE392	Control Systems
Electrical Engineering	EED391	Special Purpose Electric Machines
Emerging Science and Technology	AID391	Business Intelligence
Mechanical Engineering	MED391	Industry 4.0
Mechanical Engineering	MED392	Operations Research
Plastic and Polymer Engineering	PPE391	Waste Management and Circular Economy

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: HSM301 Course: Engineering Economics and Financial Management **Teaching Scheme:** Theory: 3 Hrs./week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II:15 Marks Continuous In-semester Evaluation: 10 marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge of concepts of economics.
Objectives	1. Understanding the principles of economics. 2. Analyzing cost-benefit analysis. 3. Recognizing the role of markets and competition. 4. Understand decision making in uncertainty. 5. Getting introduced to Indian taxing system.
Unit-I	**Introduction to Engineering Economics** Introduction to Economics, Importance, and scope of economics in engineering, Economic analysis and its role in project management, Overview of economic principles and concepts relevant to engineering, Micro - and macro- economics, economics of growth and development, Demand, and supply analysis. **(6 Hrs.)**
Unit-II	**Cash Flow and Time Value of Money** Interest rates, compounding, and discounting, Present value and future value analysis, Equivalent annual cost analysis. Cash Flow – Diagrams, Categories & Computation, Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis, Calculating Rate of Return, Incremental Analysis. **(6 Hrs.)**
Unit-III	**Elements of Managerial Economics** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time

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	of money (present and future worth of cash flows). Business Forecasting – Elementary techniques.. **(6 Hrs.)**
Unit-IV	**Rate analysis and Tendering** Rate analysis - Purpose, importance, and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. **(3 Hrs.)** Tendering - Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, penalty and liquidated charges, Settlement of disputes. Bid conditions, alternative specifications, Alternative Bids, Bid process management **(3 Hrs.)**
Unit-V	**Decision-making under Risk and Uncertainty** Probability and risk assessment in engineering projects, Sensitivity analysis and scenario analysis, Decision trees and expected value analysis, Real options analysis. **(3 Hrs)** **Depreciation** Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation **(3 Hrs)**
Unit-VI	**Personal Financial Management** Insurance, Investment, Insurance Vs investment, Investment types, Equity and debt, Investment options, lumpsum, SIP, STP, Compounding effects of investment, Investment analysis, Introduction to Stock market, fundamental and technical analysis, Derivatives, Types of derivatives, Trading awareness **(3 Hrs.)** Indian Taxing System, Types of tax: Direct and indirect taxation in India, Excise duty, GST, Income tax introduction, Income Tax calculations, example **(3 Hrs.)**

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	Sr. No.	Title	Author	Publication	Edition
References	1.	Economics for Engineers	James L.Riggs, David D. Bedworth, Sabah U. Randhawa	McGraw-Hill	fourth
	2.	Engineering Economics Analysis	Donald Newnan, Ted Eschembach, Jerome Lavelle	OUP	
	3.	Principle of Engineering Economic Analysis	John A. White, Kenneth E.Case,DavidB.Pratt	John Wiley	
	4.	Engineering Economics	R.Paneerseelvam	PHI	
	5.	Engineering Economics Analysis	Michael R Lindeburg	Professional Pub	
	6	Managerial Economics	V. Mote, S. Paul, G. Gupta(	Tata McGraw Hill	2004
	7	Principles of Economics	Mankiw Gregory N.	Thompson Asia	2002

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Syllabus of T. Y. B. Tech. (AIDS) Semester V

Course Code: AID301 Course: Data Engineering **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Programming language, Mathematics and Statistics
Objectives	1. Discover the basics of data engineering. 2. Create a basic data pipeline and visualise the data.
Unit-I	**Introduction to Data Engineering** Definition and Overview of Data Engineering, Raw Data, Data Engineering Roles, Data Engineering Process, The Modern Data Stack, Introduction to Data Pipelines, Data Engineering Vs Data Science, Data Preprocessing, Data engineering tools **(6 Hrs.)**
Unit-II	**SQL** Into to Postgres and psql, SQL Basics, Types of Joins, Advanced SQL Features - subqueries, CTE's, and Window functions **(6 Hrs.)**
Unit-III	**Source Systems and Data Ingestion** Data Lake, Data Warehouse, Data Lakehouses, Source Systems, Replication of source data, Batch Processing, Data Ingestion: Introduction to Data Ingestion, Types of Data Ingestion, Data Ingestion vs. ETL, Data Ingestion tools, Data Ingestion Best Practices and Challenges, Streaming Bulk ingestion using the Copy command. **(6 Hrs.)**

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Unit-IV	**Data Cleansing, Validation and Modeling** Data Quality of Source Systems, Statistical validation, Rule-based validation, Normalization, Dimensional Modeling, Creating Tables, Schema Migration **(6 Hrs.)**
Unit-V	**Data Presentation and Visualization** Business Intelligence Tools, Introduction to Superset, Creating visualizations. **(6 Hrs.)**
Unit-VI	**Data and Metadata Management and Governance** Data Quality, Data Catalogs, Data Lineage, Data Governance, DataOps and Data Observability **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1	Data Engineering with Python: Work with massive datasets to design data models and automate data pipelines using Python	Paul Crickard	Packt Publishing Limited	2020
2	Fundamentals of Data Engineering: Plan and Build Robust Data Systems (Grayscale Indian Edition)	Mat Housley, Joe Reis	Shroff/O'Reilly	First Edition (27 June 2022)
3	The Data Engineering Cookbook	Andreas Kretz		
4	Data Pipelines Pocket Reference: Moving and Processing Data for Analytics	James Densmore	O'Reilly Media, Inc, USA	(31 March 2021)

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) (Semester V)	
Course Code: AID302 Course: Design and Analysis of Algorithm **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisites	1. Programming in C Language 2. Discrete Mathematical Structure 3. Data Structures
Objectives	1. To provide a detailed introduction to different algorithm design paradigms with illustrative problems 2. To analyze asymptotic runtime complexity of algorithms including formulating recurrence relations. 3. To compare the performance of various algorithms.
Unit-I	**Introduction to Algorithms** Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree **(6 Hrs.)**
Unit-II	**Divide and Conquer** Divide and conquer: basic algorithm and characteristics. Binary Search: method and analysis of binary search for best, worst and average case for searches. Quick Sort, Merge Sort : method and analysis of algorithms, Strassen's matrix multiplication **(6 Hrs.)**

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Unit-III	**Greedy Method** Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Single-Source Shortest Path Algorithm. **(6 Hrs.)**
Unit-IV	**Dynamic Programming** Dynamic Programming Method: basic algorithm and characteristics., 0/1 Knapsack Problem solving using DP method, Multistage graphs, All pair shortest Path, Optimal binary search trees, Travelling salesperson problem **(6 Hrs.)**
Unit-V	**Backtracking and Branch and Bound technique** Backtracking Method: basic algorithm and characteristics, Solving n-queens problem, Sum of subsets problem, Graph colouring, Branch and bound: basic algorithm and characteristics. 15-puzzle, solving Travelling salesperson problem using branch & bound **(6 Hrs.)**
Unit-VI	**Introduction to Complexity Theory** Introduction, Class P, Class NP, NP Completeness, NP Hardness, Cook Levine Theorem Reduction of standard NP Complete Problems -SAT, 3SAT **(6 Hrs.)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Fundamentals of Computer Algorithms	Ellis Horowitz, Sarataj Sahni, S.Rajasekaran	University Press (India) Private Ltd,	2nd Edition, 2008.
2.	Introduction to Algorithms	Thomas H.Cormen	PHI Publication	2nd Edition, 2002
3.	Design and Analysis of Computer Algorithms	Aho,Hopcroft and Ullman	Pearson	1st Edition
4.	Algorithms in a Nutshell- A Practical Guide	George T. Heineman, Gary Pollice, Stanley Selkow	O'Reilly Media	2nd Edition, 2016
5.	Computer algorithms:	Sara Base	Addison-Wesley Publication,	2nd Edition

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		Introduction to Design and Analysis			

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID303 Course: Machine Learning **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisite	Basic knowledge of probability and statistics
Objectives	1. To comprehend the core ideas behind machine learning and its different algorithms 2. To understand various methods for building models out of data and assessing them 3. To apply ML algorithms on provided data and analyse the outcomes. 4. To develop a suitable ML solution to address current issues in the AI field.
Unit-I	**Introduction to Machine Learning** Machine Learning Definition, Types of learning: Supervised learning, unsupervised learning, Reinforcement learning, Semi-supervised learning, Classification, Regression, and Clustering, Data: Data Vs Information Vs Knowledge, Training Data, Validation Data and Testing Data, Machine Learning Applications. **Performance Measures:** Confusion Matrix, Classification Accuracy, Precision, Recall or Sensitivity, Support, F1 Score, AUC (Area Under ROC curve), Mean Absolute Error (MAE), Mean Square Error (MSE), R Squared (R2) **(6 Hrs.)**

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Unit-II	**Supervised Learning: Linear and Logistic Regression** Introduction to linear regression: Introduction to Linear Regression, Optimal Coefficients, Cost function, Coefficient of Determination, Analysis of Linear Regression using dummy Data, Linear Regression Intuition. Multivariable regression and gradient descent: Generic Gradient Descent, Learning Rate, Complexity Analysis of Normal Equation Linear Regression, More Complex Boundaries, Variations of Gradient Descent. **Logistic regression:** Handling Classification Problems, Logistic Regression, Cost Function, Finding Optimal Values, Solving Derivatives, Multiclass Logistic Regression, Finding Complex Boundaries and Regularization, Using Logistic Regression from Sklearn. **(6 Hrs.)**
Unit-III	**Supervised Learning: Decision Trees and Random Forests** **Decision trees:** Decision Trees, Decision Trees for Interview call, Building Decision Trees, Getting to Best Decision Tree, Deciding Feature to Split on, Continuous Valued Features Code using Sklearn decision tree, information gain, Gain Ratio, Gini Index, Decision Trees & Overfitting, Pruning. **Random forests:** Introduction to Random Forests, Data Bagging and Feature Selection, Extra Trees, Regression using decision Trees and Random Forest, Random Forest in Sklearn **(6 Hrs.)**
Unit-IV	**Unsupervised Learning: Naive Bayes, KNN and SVM** **Naive Bayes:** Bayes Theorem, Independence Assumption in Naive Bayes, Probability estimation for Discrete Values Features, How to handle zero probabilities, Implementation of Naive Bayes, Finding the probability for continuous valued features, Text Classification using Naive Bayes. **K-Nearest Neighbours:** Introduction to KNN, Feature scaling before KNN, KNN in Sklearn, Cross Validation, Finding Optimal K, Implement KNN, Curse of Dimensionality, Handling Categorical Data, Pros & Cons of KNN.

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	Support Vector Machine: Intuition behind SVM, SVM Cost Function, Decision Boundary & the C parameter, using SVM from Sklearn, Finding Non Linear Decision Boundary, Choosing Landmark Points, Similarity Functions, How to move to new dimensions, Multi-class Classification, Using Sklearn SVM on Iris, Choosing Parameters using Grid Search, Using Support Vectors to Regression. **(6 Hrs.)**
Unit-V	**Ensemble Techniques** Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, PAC learning model, Sample complexity, VC Dimension, Ensemble learning. **(6 Hrs.)**
Unit-VI	**Neural Networks** Activation functions, network training, Perceptron, multilayer network, back propagation, introduction to deep neural network. **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1	Introduction to Machine Learning	Ethem Alpaydin,	MIT Press	3rd Edition
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer, 2006	1st
3	Foundations of Machine Learning	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar,	MIT Press, 2012	2nd
4	Machine Learning	Tom M Mitchell	McGraw Hill Education, 2013.	1st

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID304 Course: Software Process and Project Management **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Database, Data Structures and Object-Oriented Concepts
Objectives	1. To acquire knowledge on software process management. 2. To obtain managerial skills for software project development. 3. To understand the basic steps of project planning, project management, quality assurance.
Unit-I	**Introduction to Software Engineering:** SDLC **Software Development Process:** Process, Tailoring the Process, Improving the process discipline - Need for implementing discipline. Software Production Process. **Basic Software Process Models:** Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model, Agile method. **(6 Hrs.)**
Unit-II	**Software Requirement Analysis, Specification:** Requirement Analysis, Types of Requirements, Feasibility Study, Data Dictionary, and Requirement Elicitation Techniques, Characteristics of SRS, Use Case Approach. Product Specifications, Defining the Final Product, Data Flow Diagram, Data Dictionary, Structured English, Decision Trees, Decision Tables - Feasibility Study. **(6 Hrs.)**
Unit-III	**Software Project Management & Organization:** Three Vital Aspects of Software Project Management: The Team, Meaning of Leadership, Communicating in Harmony, Personality traits.

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	Project Organizations. Project Planning, Top-Down and Bottom-Up Planning, Activities, Types of Activity, Project Scheduling and Staffing, Project Duration: Schedule Monitoring Tools, Gantt Chart, PERT Chart. **(6 Hrs.)**
Unit-IV	**Project Review:** Tracking Meetings, Recovery plans: Schedule Work & Escalation Meetings. Project Engineering: Product Requirements, Understanding the Customer Problem to solve -Initial Investigation, Strategies for determining information requirements, Information gathering Tools, Product Objectives. **(6 Hrs.)**
Unit-V	**Software Quality Management:** Software Quality, Quality Measures, FURPS, Software Reviews, Format Technical Review (FTR), Software Reliability: The Software Quality Assurance Plan, Formal approaches to SQA. **Introduction to Software Testing:** Testing Life Cycle, Types of Testing, Test Plan. **(6 Hrs.)**
Unit-VI	**CCPDS -R** Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions. **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1	Software Engineering	Roger S Pressman	McGraw Hill2019	8th
2	Fundamentals of Software Engineering	Carlo Ghezzi,	Prentice Hall India, ISBN-10: 0133056996	1st
3	An Integrated Approach to Software Engineering.	Pankaj Jalote	Springer, ISBN 13: 9788173192715	3rd
4	Handbook of Software	Tom Halt	Clanye	1st
5	Fundamentals of Software Engineering	Rajib Mall	Prentice Hall India, ISBN-13: 978-8120348981	1st

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID321 Course: Lab-I Data Engineering **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 Teacher Assessment: 25 Marks
Objectives	1. To give a hands-on experience with real-world data analysis 2. To construct Data engineering infrastructure 3. To work with data pipeline
List of Practical	1. Build the data engineering infrastructure. 2. Build data pipelines to read and write files. 3. Build the data pipelines to work with database. 4. Perform data cleaning, data transformation and data enriching. 5. Build a 311 data pipeline. 6. Build idempotent and atomic data pipeline. 7. Implement version control with NiFi registry and monitor the data pipeline. 8. Deploy data pipeline. 9. Build a production data pipeline. 10. Stream data with Apache Kafka

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID322 Course: Lab-II Design and Analysis of Algorithm **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 ESE/Oral: 25 Marks
Objectives	1. To implement searching and sorting algorithms using Divide and Conquer technique. 2. To implement Greedy algorithms for problem Solving 3. To implement dynamic and backtracking algorithms to solve problems
List of Practical	Design, develop and implement the following programs using C or C++ language. 1. Program to implement linear, binary search using recursion. 2. Program for Quick sort using Divide and Conquer 3. Program for Merge sort using Divide and Conquer. 4. Program to implement Fractional Knapsack problem using Greedy method. 5. Program to implement single source shortest path. 6. Program to implement Floyd Warshall's algorithm for solving all pairs Shortest Path problem 7. Program to implement 0/1 Knapsack problem using Dynamic programming. 8. Program to implement Traveling sales person problem using Dynamic programming 9. Program to implement 8-Queens' problem using Backtracking. 10. Program to implement sum of subset problem using Backtracking.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID323 Course: Lab-III Machine Learning **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 End Semester Examination / Oral: 25 Marks
Objectives	1. To understand & apply classification and regression algorithms. 2. To understand & implement supervised machine learning to solve problems. 4. To understand & apply unsupervised machine learning to solve problems.
List of Practical	1. Understand the Python Libraries required for ML application such as Numpy , Pandas and Matplotlib and implement simple programs using these libraries. 2. Write a python program using Statistics library to compute Central tendency measures: Mean, Median, Mode Measures of Dispersion: Variance, Standard Deviation 3. Write a Python program to implement Simple Linear Regression for diabetes dataset. 4. Implement Multiple Linear Regression for House Price Prediction using sklearn. 5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. 6. Implement Decision tree using sklearn and its parameter tuning . 7. Write a program to implement K-Nearest Neighbour algorithm. 8. Implement Logistic Regression using sklearn to predict whether the patient is diabetic or not. 9. Write a program to implement SVM algorithm. Apply K-means algorithm to cluster a set of data stored in a .csv file.

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester V	
Course Code: AID324 Course: Lab-IV: Seminar **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 1 ESE/Oral: 25 Marks
Objectives	1. To encourage the students to study advanced engineering developments. 2. To develop skills in doing literature survey, technical presentation, and report preparation. 3. To prepare and present technical reports. 4. To encourage the students to use various teaching aids such as power point presentation and demonstrative models.
Guidelines	Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned. To encourage and motivate the students to read and collect recent and reliable information about their area of interest confined to the relevant discipline, from technical publications including peer reviewed journals, conferences, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
Evaluation	Distribution of marks for the seminar is as follows:

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	• Topic Selection and Technical Contents: 30 % • Presentation: 20% • Ability to answer questions: 20% • Report: 30%. Evaluation is based on rubrics prepared based on above guidelines.

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester VI	
Course Code: AID325 Course: Lab-V: Experienced based learning **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 1 Teacher's Assessment: 25 Marks
Objectives	1. To promote professional skills and knowledge through hands on experience. 2. To inculcate independent learning by problem solving with social context.
Attributes	The following attributes are necessary in some combination, • The goal of experience-based learning involves something personally significant or meaningful to the students. • Students should be personally engaged. • Reflective thought and opportunities for students to write or discuss their experiences should be ongoing throughout the process. • The whole person is involved, meaning not just their intellect but also their senses, their feelings and their personalities. • Students should be recognised for prior learning they bring into the process.
Guidelines	**Stages of Experiential Learning Cycle** **1. Concrete Experience:** It describes the hands-on experiences that it is learn from. It's here that to try new things, face problems and step out of our comfort zone. **2. Reflective Observation** Next, it is needed to reflect to learn from the experiences. The 'reflective observation' phase of the experiential learning cycle is all about reflection on the experiences which include both action and feelings. It is a stage get to reflect on what went right and what could be improved? It's also a chance to observe

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how it could have been done differently and to learn from each other.

3. Abstract Conceptualization

Once it has been identified and understood the defining characteristics of an experience, it can decide on what can be done differently next time. This is a time for planning and brainstorming steps for success.

4. Active Experimentation

The active experimentation phase of the learning cycle is where the experimentation with the ideas is done. It's time to put the plan of action to the test in the real world.

The active experimentation phase of the learning cycle is where there is need to experiment with the ideas. It's time to put plan of action to the test in the real world.

Following activities may be performed under experience-based learning.

- Role Play
- Case Studies
- Field Visits
- Undergraduate Research
- Question generating activity
- Fishbowl
- Make a Mnemonic
- Peer Group Learning
- Group 'Change' Projects
- Creative Problem-Solving

Assessment:

Assessment will be done through following ways.

- Creating a reflective journal or a portfolio
- Essay, report, or presentation (could be arts-based, multimedia or oral) on what has been learnt
- Short answers to questions of a 'why' or 'explain' nature
- One-on-one oral assessments with the instructor

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	• A project that develops ideas further (individually or in small groups) • Self-evaluation and/or group evaluation of a task performed Rubrics shall be prepared for the activities in which the performance is to be evaluated. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. EBL is monitored and continuous assessment is done by mentor and authorities.

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Syllabus of T. Y. B. Tech. (AIDS) Semester V

Course Code: AID326 Course: Lab-Development of Skills (Computational) UI/UX Design **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 Teacher's Assessment: 25 Marks

Objectives	1. To implement graphical layout of an application / product 2. To understand user interface 3. To understand and apply concepts of UI/UX design.
List of Practical	1. Introduction to UI/UX 2. Intro to design methodologies used by industry professionals. 3. Wireframe Information Architecture 4. Use workflows. 5. Wireframe elements and tools. 6. Wireframe ridgeline. 7. sketch wireframes using different representations of web elements. 8. Prototyping with Figma 9. Sharing and exporting Figma Files. 10. Interaction and animation using Figma.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID351 Course: Data Analytics and Modelling **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Data Engineering
Objectives	1. Apply the data transformation/modelling techniques. 2. To learn the probabilistic model of data science. 3. Understand the basic concepts of data analytics.
Unit-I	**Unit 1: Data Definitions and Analysis Techniques** Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Data Analysis types: Descriptive, Diagnostic, Predictive **(6 Hrs.)**
Unit-II	**Data transformation and standardization** Box-Cox and power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transforms, Normal transform **(6 Hrs.)**
Unit-III	**Descriptive Statistics** Counts and specific values, Measure of central tendency, Measure of spread, Measure of distribution shape, Statistical indices, Moments, Key functions, Measures of complexity and model selection. Measures of location of dispersions. **(6 Hrs.)**
Unit-IV	**Basic Analysis Techniques** Goodness of fit tests: Anderson-Darling, Chi-square test, Kolmogorov-Smirnov, Ryan-Joiner, Shapiro-Wilk, Jarque-Bera, Lilliefors; Z- test: test of single mean,

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	standard deviation known, Test of the difference between two means, standard deviation known, test for proportions, P; T-tests: test of single mean, standard deviation not known, Test of the difference between two means, standard deviation not known, test of regression coefficients **(6 Hrs.)**
Unit-V	**Analysis of Variance and Covariance** Variance test: Chi square test of single variable, F-test of two variables, test of homogeneity; Wilcoxon rank-sum/Mann-Whitney U test; Sign test. Contingency Tables: Chi-square contingency table test, G contingency table test, Fisher's exact test, Measures of association, McNemar's test. ANOVA: Single factor or one way ANOVA, Two factor or two-way and higher-way ANOVA, MANOVA, ANCOVA; Non Parametric ANOVA: Kruskal Wallis ANOVA, Friedam ANOVA test, Mood's median, Correlation analysis, Maximum likelihood test **(6 Hrs.)**
Unit-VI	**Exploratory Data Analysis and Statistics** Inferential Statistics, Hypothesis testing, Univariate Analysis, Bivariate Analysis, Derived Metrics, Sampling and Sampling Distribution **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1	Probability & statistics for Engineers & Scientists	Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye	Packt Publishing Limited	9th Edition
2	Statistical Analysis Handbook, A Comprehensive guide to statistical concepts methods and tools	Dr. Michael J de Smith	The Winchelsea Press, Drumlin Security Ltd	2018
3	Applied Statistics and Probability for Engineers	Douglas C. Montgomery, George C. Runger	Wiley	Sixth Edition, 2013

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	4	Probability And Statistics for Engineers	Dr.J.Ravichandran	Wiley	First Edition

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID352 Course: Artificial Neural Network and Deep Learning **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisite	Machine Learning Basic Concepts
Objectives	1. Understand the concepts of deep learning 2. Understand the working and use of various Neural Networks models.
Unit-I	**Foundations of Deep learning** What is machine learning and deep learning?, Supervised and Unsupervised Learning, bias variance tradeoff, hyper parameters, under/over fitting regularization, Limitations of machine learning, History of deep learning, Advantage and challenges of deep learning. Learning representations from data , Understanding how deep learning works in three figures, Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning, Introduction and use of popular industry tools such as TensorFLow, Keras, PyTorch, Caffe, Shogun. **(7 Hrs.)**
Unit-II	**Deep Neural Networks(DNNs)** Introduction to Neural Networks :The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks , Training Neural Networks :Backpropagation and Forward propagation Activation Functions :Linear ,Sigmoid, Tannh, Hard Tanh, Softmax, Rectified Linear, Loss Functions :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction, Hyperparameters : Learning Rate, Regularization, Momentum, Sparsity, Deep

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	Feedforward Networks – Example of Ex OR, Hidden Units, cost functions, error backpropagation, Gradient-Based Learning, Implementing Gradient Descent, vanishing and Exploding gradient descent, Sentiment Analysis, Deep Learning with Pytorch, Jupyter, colab. **(7 Hrs.)**
Unit-III	**Convolution Neural Network(CNN)** Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network **(7 Hrs.)**
Unit-IV	**Recurrent Neural Network(RNN)** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory. Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyper parameters. **(7 Hrs.)**
Unit-V	**Deep Generative Models** Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), discriminator network, generator network, types of GAN, Applications of GAN networks **(7 Hrs.)**
Unit-VI	**Reinforcement Learning** Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning,Q Learning and

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	Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning for Tic-Tac-Toe. **(7 Hrs.)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Deep Learning	Goodfellow, I., Bengio, Y.,,Courville	MIT Press	2016
	2	Deep Learning	Josh Patterson & Adam Gibson	O'Reilly	2017
	3	Neural Networks and deep learning	Charu Agarwal	Springer	2018
	4	Reinforcement Learning: An Introduction	Richard S. Sutton and Andrew G. Barto	The MIT Press	

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID353 Course: Operating System **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-1-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisites	C Programming, Data Structures, Computer Organization
Objectives	1. Student should learn fundamentals which will help them to understand design of modern operating system. 2. To study different components of OS. 3. Students should have overview of different Types and Structure of OS. 4. Students should learn important system resources and their management policies
Unit-I	**Introduction** Operating System Objectives and Functions: The OS as a User/Computer Interface, OS as a resource manager. Evolution of Operating system: Batch System, multiprogramming, time sharing, multitasking, distributed, handheld Computer System, Embedded OS, Real Time, Smart Card OS. Operating System Structure: Monolithic Systems, layered Systems. Micro Kernels, Client Server Model Virtual Machines. Exokernels. System Calls and Shell. **(6 Hrs.)**
Unit-II	**Process Management** Process concept. Process states (two state, five state), Process Description, PCB. CPU scheduling- scheduling criteria, Scheduling Algorithms. Thread: Process and "threads, Thread functionality, User level and Kernel level threads. Process Synchronization Principle of concurrency, Race condition. Critical Sections/Regions Mutual Exclusion, Sleep and wakeup, Producer consumer

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	problem, Semaphore, Monitors, Message Passing. Dining Philosopher Problem, Readers, and writers' problem. **(8 Hrs.)**
Unit-III	**File Systems** Overview: File, File Management System, File System Architecture, File Management Functions. File Organization and access, File System Layout. File Directories, File Sharing. Secondary Storage Management: File Allocation, Disk space management. File System Consistency and Performance, Comparison of Windows, and UNIX File System. **(6 Hrs.)**
Unit-IV	**Memory Management** Memory Management Requirements, Relocation, Protection, Sharing, Logical Organization, Physical Organization. Memory Partitioning: Fixed, Dynamic Partitioning, Buddy Systems, Relocation Fragmentation, Swapping. Managing free Memory: Memory management with bitmap, linked list. Paging: Basic Method, hardware support, Structure of page Table. Segmentation: Basic Method, hardware. Virtual Memory: Demand Paging, Page replacement Algorithms- optimal, FIFO, LRU, Allocation of Frames, Thrashing and Working Set Model. **(8 Hrs.)**
Unit-V	**Device Management** Principles of I/O Hardware: I/0 devices, Device Controllers. Principle of I/O software, I/0 Software Layers, Disk: Disk hardware -Magnetic CDs, DVDs Disk, RAID, Disk Formatting, Disk Scheduling Algorithms, Clocks. **(6 Hrs.)**
Unit-VI	**Deadlock and Case study** Deadlock, System model, Characterization, Deadlock Prevention, Deadlock avoidance -Bankers Algorithm for single and multiple resources, Deadlock detection and recovery, Case study of Window 10- History of Windows, System Structure, Windows Registry, Process and thread management, Concurrency control, Memory Management and I/O Management, Security.

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	Case study of Linux- History of Linux, System Structure, file system, Process and thread management, Security. (6 Hrs.)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Operating System Concepts	Abraham Silberschatz, Peter Galvin	Addison Wesley	6th edition
	2.	Modern Operating Systems	Andrew S. Tanenbaum	Prentice Hall	3rd Edition
	3.	Operating System Design & Implementation	Andrew S. Tanenbaum	Pearson Education	2nd edition
	4.	Operating systems	William Stallings	prentice hall	4" Edition

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Syllabus of T. Y. B. Tech. (AIDS) Semester VI

Course Code: AID354 Course: Dependable AI (Trustworthy AI System) **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisites	Introduction to AI
Objectives	1. Student should learn fundamental concepts of Dependable AI. 2. Understand the trustworthy AI practices.
Unit-I	**Introduction to Dependable AI** Types of AI models and Use cases, new challenges for modern AI era, a longstanding ethical question, tradeoffs in fairness, Robust and Reliable AI, The challenges of generalizable Deep Learning, factors affecting AI reliability **(6 Hrs.)**
Unit-II	**Transparent AI** Defining the nature of transparency, The limits of transparency, Trust from transparency, Secure and Safe AI **(6 Hrs.)**
Unit-III	**Explainable AI** The components of understanding AI function, the value in explainable AI, Technical approaches for fostering explainability, Leading practices in process, Explainable imperative. **(6 Hrs.)**
Unit-IV	**Accountable AI** Balancing innovation and accountability, laws, lawsuits and liability, Leading practices in accountable AI **(6 Hrs.)**
Unit-V	**Responsible AI** Corporate responsibility in the AI era, motivating for responsible AI use, Leading practices in responsible AI **(6 Hrs.)**

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Unit-VI	**Trustworthy AI in practice** Identification of relevant dimensions of trust, cultivating trust through people, process and technology, guidelines for action on Trustworthy AI **(6 Hrs.)**				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Archived from the original on 2022-10-24. Retrieved 2022-10-24.	This article incorporates text from this source, which is by the International Telecommunication Union	Available under the CC BY 4.0 license.	
	2	Trustworthy AI: A Business Guide for Navigating Trust and Ethics in AI	Ammanath, Beena	John Wiley & Sons.	2022
	3	Trustworthy AI - Integrating Learning, Optimization and Reasoning: First International Workshop	Heintz, Fredrik; Milano, Michela; O'Sullivan, Barry	Springer International Publishing. ISBN 978-3-030-73958-4.	

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)	
Course Code: AED391 Course: Open Elective-III Fundamentals of Bioenergy **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge of Bioenergy sources and biomass utilization
Objectives	1. Understand bioenergy technologies, processes, reactions and energy conversion rates for Anaerobic Digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion 2. Know what constitutes a suitable feedstock for bioenergy applications
Unit-I	**Introduction to bioenergy** Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Basic Biomass Technology (Resources and Production) Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. **(6 Hrs)**
Unit-II	**Bioethanol-** Biofuels: Introduction, Ethanol production process, Biodiesel production process, Environmental Benefits, Bio-oil: Pyrolysis or Destructive distillation. **(6 Hrs)**
Unit-III	**Biogas-** Biogas: Introduction, process description, Constituents of biogas, main features of biogas plant, Classification & Popular designs, Applications, factors considered for selection of biogas plant, advantages, disadvantages. **(6 Hrs)**

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Unit-IV	**Biodiesel-** Biodiesel production processes, Biodiesel characterization, Biodiesel feedstocks, Environmental permitting and safety considerations for biodiesel production. **(6 Hrs)**
Unit-V	**Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, chemistry of gasification, Gasification Types – Updraft Gasifier, downdraft, cross draft, applications, difference. **(6 Hrs)**
Unit-VI	**Biomass utilization:** Biomass densification technique (briquetting, pelletization, and cubing), environmental aspect of bio-energy, waste to energy conversion. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson, Kenneth L. Starcher	CRC Press	1st
2	Bioenergy: Biomass to Biofuels	Anju Dahiya	Elsevier Science	2nd
3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley	2nd

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Syllabus of T. Y. B.Tech. Civil Engineering (Semester VI)

Course Code: CED391 Course: Open Elective-III Solid Waste Management **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Environmental Science
Objectives	To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
Unit-I	**Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and biological properties. **(6 Hrs.)**
Unit-II	**Generation of solid waste: Factors affecting. Storage and collection:** General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. **(6 Hrs.)**
Unit-III	**Segregation and Material Recovery** Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management. **(6 Hrs.)**
Unit-IV	**Waste processing: processing technologies** Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing,

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	Pyrolysis, Incineration, Advantages and disadvantages of various technological options. **(6 Hrs.)**
Unit-V	**Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site. **(6 Hrs.)**
Unit-VI	**Hazardous waste management (HWM):** Types of hazardous waste (such as nuclear, biomedical and industrial waste), problems and issues related to HWM, Need for HWM, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labelling and handling of hazardous wastes, incineration, solidification & stabilization of hazardous waste. **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1	Integrated Solid Waste Management	Hilary Theisen and Samuel A, Vigil	McGraw-Hill, New York	1993
2	CPHEEO, Manual on Municipal Solid waste management,	Central Public Health and Environmental Engineering Organization	Government of India	2000
3	Environmental Resources Management, Hazardous waste Management	Michael D. LaGrega, Philip L Buckingham Jeffrey C. E vans	Mc-Graw Hill International edition	2001
4	Solid waste Engineering	Vesilind P.A., Worrell W and Reinhart	Thomson Learning Inc., Singapore	2002

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	5	Hazardous Waste Management	Charles A. Wentz	McGraw Hill International Edition,New York	2nd

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE391 Course: Open Elective-III RHCSA (RedHat Certified System Administration) **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisites	This course has prerequisites like previous system administration experience on other operating systems is beneficial. Fundamental knowledge of Operating System.
Objectives	1. Develop a strong understanding of the command-line interface (CLI) and become proficient in using essential command-line tools and utilities for system administration tasks. 2. Understanding fundamental system administration tasks, such as managing file systems, users, and groups. 3. Ability to Install, update, and remove software packages using package management tools and service management. 4. Ability to identify and resolve common system issues, perform system analysis, and troubleshoot problems related to hardware, software. 5. Ability to configure and troubleshoot network interfaces and handlingsystem security. 6. Ability to manage storage devices and file systems and utilize containerization tools like Podman.

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Unit-I	**Introduction to Red Hat Enterprise Linux (RHEL, Filesystem and File Permissions** Overview of RHEL and its features. Installation and deployment of RHEL, Filesystem hierarchy standard (FHS), Managing files and directories. **(6 Hrs.)**
Unit-II	**User and Group Administration** Permissions and ownership User andgroup management, Password policies and authentication methods, User and group quotas user and group-level security measures, such as password policies and file permissions, to maintain system integrity. **(6 Hrs.)**
Unit-III	**Package Management, System Initialization** Package installation, removal, and verification Managing software repositories, Dependency resolution and package querying, Boot process and run levels Managing services and daemons, Systemd and SysVinit. **(7 Hrs.)**
Unit-IV	**System Maintenance, Troubleshooting and System Recovery** System updates and patching, Kernel management, Managing log files and system monitoring, System troubleshooting methodologies, Rescue and recovery techniques, Boot loader configuration and troubleshooting. **(7 Hrs.)**
Unit-V	**Network Configuration** Network interfaces and configurations, IP addressing and routing, DNS configuration. configuring firewalls, securing SSH access, and implementing SELinux policies to protect the system from unauthorized access and potential threats. **(7 Hrs.)**
Unit-VI	**Storage Administration & Run containers** Disk partitioning and formatting, Logical Volume Manager (LVM), Filesystem creation and mounting, Deploy Container, Manage Container Storage and Network Resources, Manage Containers as System Services. **(7 Hrs.)**

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	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Linux System Programming	Robert Love	O'Reilly, SPD	10th
	2.	UNIX Network Programming	W.R. Stevens	McGraw-Hill	5th
	3.	Linux Command Lineand Shell Scripting Bible	Richard Blum and Christine Bresnahan	McGraw Hill	6th
	4.	UNIX and Linux System Administration Handbook	Evi Nemeth, Garth Snyder, Trent R. Hein	Ben Whaley	3rd
	5.	RHCSA/RHCE Red Hat Linux Certification Study Guide	RedHat Student Guide	RedHat	9th

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE392 Course: Open Elective-III: Digital Marketing **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisites	Basic Understanding of Digital Marketing
Objectives	1. To understand the basic concept of digital marketing 2. To understand the concept of search engine optimization. 3. Implement Social Media Optimization 4. Discuss the concept of google advertising
Unit-I	**Digital Marketing Introduction** Concept of Digital Marketing, Use of Digital Marketing, Digital Marketing Platform, Digital Marketing Strategy, Types of Digital Marketing – Organic & Paid, Digital Marketing VS Traditional Marketing. How is it different from traditional marketing, ROI between Digital and traditional Marketing. **(7 Hrs.)**
Unit-II	**Search Engine Optimization (SEO)** Introduction of SEO, Search Engine working, SEO Tools Web position Analysis, Competition Analysis, Google Algorithms and Updates. **(6 Hrs.)**
Unit-III	**Social Media Optimization (SMO)** **Facebook** - Profile Creations, Creating groups and pages, Tips and Guides, Posts And promotions, Events Creations, Video Marketing, Promotional Techniques, Integration Techniques. **Twitter** -Set-up and usage Tips, Promoted Tweets, Video Marketing, Promotional Techniques, Integration

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	Techniques, Analytics. **LinkedIn**-Profile Creations, Company Page Creations, Tips and Guides, LinkedIn posts LinkedIn promotions LinkedIn Groups, Video Marketing, Promotional Techniques, IntegrationTechniques, **Instagram** -Integration Techniques, Promotional Techniques. **(5 Hrs.)**
Unit-IV	**Introduction to SEM** Google AdWords, Search Advertising, Display Advertising, Mobile Advertising, Video Advertising, Shopping Advertising, Report generation, Google AdWords Express, Setup, Google Mapping Ads. **(6 Hrs.)**
Unit-V	**E-Commerce Management** Maintenance of an online product-listing website through product keyword research, product pricing, positive reviews, and customer retention. **(6 Hrs.)**
Unit-VI	**Email Marketing** How to create and send product-based emails in bulk, and ensure that all of the emails have a good open rate and conversion rate. **(6 Hrs.)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Digital Marketing For Dummies	Ryan Deiss & Russ Henneberry	Tata McGraw Hill	6th
2.	SocialMedia Marketing All-in-one Dummies	Jan Immerman, Deborah Ng	Prentice Hall	3rd
3.	Digital Marketing	Seema Gupta	Tata McGraw Hill	1st

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Faculty of Science and Technology Syllabus of Third Year B. Tech Electronics and Computer Engineering Semester-VI	
Course Code: ECE391 Course: Data Science **Teaching Scheme:** Lectures: 3 Hrs./ Week Tutorial: - Hr./ Week	Credits: 3 – 0 – 0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs.

Prerequisites	Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics.
Objectives	The objectives of the course are. • Give an introduction to data science and its applications. • Understand use of statistics in data science • Use data science to analyze large and unstructured data with different tools
Course Outcomes	At the end of the course the student will be able to 1. Demonstrate the fundamental concepts and principles of data science. 2. Apply data preprocessing techniques to clean and prepare data for analysis. 3. Perform statistical analysis and interpret the results. 4. Implement and evaluate machine learning algorithms for data prediction and classification.
Unit-I	**Introduction to Data Science:** Overview of Data science and its terminologies, Applications of Data Science, Role of Data science in emerging technologies. Data types and Data sources, Data preprocessing techniques, Statistical concepts for Data Science. **(6 Hrs.)**
Unit-II	**Machine Learning for Data Science:** Introduction to machine learning algorithms, Supervised learning: linear regression, logistic regression, decision trees, and random forests, Unsupervised learning: clustering algorithms, dimensionality reduction, Feature generation and selection using Machine learning. **(6 Hrs.)**

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Unit-III	**Data Visualization and Communication:** Principles of data visualization, Exploratory data analysis using visual techniques Tools and libraries for data visualization. Mining Social Networks: Social Networks graphs, clustering of graphs, direct discoveries of communities in graphs, analyze the portioning of graphs, the neighborhood properties of graphs. **(6 Hrs.)**
Unit-IV	**Big Data Analytics and cloud computing for Data Science:** Introduction to big data and its challenges, Distributed computing frameworks: Hadoop and Spark, Big data processing and analysis. Cloud concept and computing for data science. **(6 Hrs.)**
Unit-V	**Programming Languages and libraries for Data Science:** Python for Data Science, Python libraries for data science. R programming language for Data science. Implementation examples in Python and R language. **(6 Hrs.)**
Unit-VI	**Ethical Considerations in Data Science**: Privacy, security, and ethical considerations in data science, Bias, fairness, and interpretability in machine learning algorithms, Legal and regulatory aspects of data science. **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Python for Data Analysis	Wes McKinney	O'Reilly Media	2nd
2.	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd
3.	Data Science for Business	Foster Provost, Tom Fawcett	O'Reilly Media	1st
4.	Hands-On Machine Learning with Scikit-Learn and TensorFlow	Aurélien Géron	O'Reilly Media	2nd
5.	Doing Data Science: Straight Talk from The Frontline	Cathy O 'Neiland Rachel Schut	O'Reilly Media, Inc	3rd

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Faculty of Science and Technology
Syllabus of Third Year B. Tech Electronics and Computer Engineering
Semester-VI

Course Code: ECE392	Credits: 3 – 0 – 0
Course: Control Systems	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Lectures: 3 Hrs./ Week	Teacher Assessment: 10 Marks
Tutorial: - Hr./ Week	Continuous Internal Evaluation: 10 Marks
	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 02 Hrs.

Prerequisites	Linear algebra and calculus
Objectives	The objectives of the course are • The objective of this course is to introduce students to the fundamental concepts and principles of control systems. • Students will develop an understanding of the analysis and design of control systems, including time-domain and frequency-domain techniques.
Course Outcomes	At the end of the course the student will be able to 1. Understand the basic concepts and terminology of control systems. 2. Analyze linear time-invariant (LTI) systems using Laplace transforms and transfer functions. 3. Design and analyze feedback control systems using time-domain techniques. 4. Analyze control system stability using Routh-Hurwitz and Nyquist criteria.
Unit-I	**Introduction to Control Systems** Definition and classification of control systems, Feedback and feedforward control, Open-loop System, closed-loop control and their examples. Distinguish between open and close system. Laplace transforms. **(6 Hrs.)**
Unit-II	**Mathematical Modeling of Dynamic Systems** Differential equations and transfer functions, Advantages, Disadvantages and Properties of Transfer function, transfer function representation, Block diagrams and signal flow graphs, State-space representation. **(6 Hrs.)**

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Unit-III	**Time-Domain Analysis** Time response analysis, Step response analysis. Time constant and system behavior. Transient and steady-state response. Second-order system characteristics: Step response analysis. Natural frequency and damping ratio. Undamped, underdamped, critically damped, and overdamped systems Performance specifications: Rise time, settling time, peak time, and peak overshoot. Steady-state error and error constants. Introduction to error analysis. **(6 Hrs.)**
Unit-IV	**Stability Analysis:** Definition of stability, Stability conditions based on the Routh array, Application of the Routh-Hurwitz criterion to analyze system stability. Nyquist stability criterion, Application of stability criteria to determine system stability. **(6 Hrs.)**
Unit-V	**Frequency-Domain Analysis:** Frequency response analysis, Relationship between time-domain and frequency-domain representations, Bode plots, Nyquist stability criterion, Stability margins, gain margin and phase margin. **(6 Hrs.)**
Unit-VI	**Controller Design:** Sensors and actuators, Sampling and discrete-time control systems, Proportional-Integral-Derivative (PID) controllers, Frequency response design (lead, lag, and lead-lag compensation), Digital controllers and hardware implementation. **(6 Hrs.)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Modern Control Engineering	Katsuhiko Ogata	--	--
2.	Control Systems Engineering	Norman S. Nise	--	--
3.	Feedback Control of Dynamic Systems	Gene F. Franklin, J. David Powell, and Abbas Emami-Nacini	--	--
4.	Automatic Control Systems	Benjamin C. Kuo and Farid Golnaraghi	--	--

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Syllabus of S. Y. B.Tech. (Electrical Engineering) (Semester III)

Course Code: EED391 Course: Open Elective-III Special Purpose Electric Machines **Teaching Scheme:** Theory: 3 Hrs. / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic electrical Engineering, magnetic circuit, conventional electrical machines
Objectives	1. To understand different types of motors for particular application 2. To examine behaviour of machines for specific applications 3. To compare different machines 4. To develop knowledge in regards of control and use of machines
Unit-I	**Induction Generators** Construction, operating principle, types, operating characteristics, Applications. **(6 Hrs.)**
Unit-II	**Doubly fed induction Machines** Construction, operating principle, types, operating characteristics, Applications to grid connected wind and mini/micro hydel systems. **(6 Hrs.)**
Unit-III	**Switched Reluctance Motor:** Construction, operating performance, control and applications. **Variable reluctance stepper motor:** Construction, operating performance, control and applications. **(6 Hrs.)**
Unit-IV	**Linear Machines:** Linear Induction Machines and Linear Synchronous Machines: Construction, operation, performance, control and applications. **(6 Hrs.)**
Unit-V	**BLDC Machine** Construction, magnetic materials used, types of motors, control and applications. Recent developments in BLDC motors. **(6 Hrs.)**

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Unit-VI	**Permanent Magnet Machines:** Construction, magnetic materials used, types of motors e.g. PMDC and PM Synchronous Machine, control, and applications. Recent developments in electrical machines. **(6 Hrs.)**				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Switched Reluctance motor drives'	R.Krishnan,	CRC press, 2001	1st Edition
	2	Permanent magnet and Brushless DC motors'	T.Kenjo and S.Nagamori	Clarendon press. London, 1988	1st Edition
	3	Special Electrical Machines	Simmi P Burman	S.K. Kataria& Sons	2nd Edition
	4	Permanent Magnet Synchronous and Brushless DC Motor Drives	R. Krishnan.	New Delhi, Prentice, Hall of India, 2009	2nd Edition
	5	Special Electrical Machines	Venkataratnam	Taylor and Francis, 2009	1st Edition

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID391 Course: Business Intelligence **Teaching Scheme:** Theory: 03 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisites	No Prerequisites
Objectives	1. Student should learn fundamental concepts of Business Intelligence. 2. To learn analytics framework to support decision making in business intelligence.
Unit-I	**Understanding Business Intelligence** The Challenge of Decision Making, What Is Business Intelligence?, The Business Intelligence Value Proposition, The Combination of Business and Technology **(6 Hrs.)**
Unit-II	**Business Intelligence Technology Counterparts** Data Warehousing: What Is a Data Warehouse?, Data Marts and Analytical Data, Organization of the Data Warehouse Enterprise Resource Planning: Distributing the Enterprise, First ERP, then Business Intelligence, The Current State of Affairs Customer Relationship Management: CRM, ERP, and Business Intelligence Customer Decisions, Decisions About Customers, Business Intelligence and Financial Information **(6 Hrs.)**
Unit-III	**The Spectrum of Business Intelligence** Enterprise and Departmental Business Intelligence, Strategic and Tactical Business Intelligence, Power and Usability in Business Intelligence, Finding the Right Spot on the Continuum, Business Intelligence: Art or Science? **(6 Hrs.)**

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Unit-IV	**Business Intelligence User Interfaces** Querying and Reporting, Reporting and Querying Toolkits, Basic Approaches: Building Ad-Hoc Queries, Building On-Demand Self-Service Reports, Enhancing and Modifying, Data Access: Pull-Oriented Data Access, Push-Oriented Data Access, Dashboards: EIS Is the Engine, Metric System and KPIs, Business Intelligence Dashboards **(6 Hrs.)**
Unit-V	**On-Line Analytical Processing (OLAP)** OLAP:OLAP and OLTP, Operational Data Stores, Variations in Data and Approach, OLAP Applications and Functionality, Multi-Dimensions: Thinking in More Than Two Dimensions, What Are the Possibilities?, Drilling and Pivoting, OLAP Architecture: Cubism, Tools, ROLAP, MOLAP, HOLAP, Data Mining **(6 Hrs.)**
Unit-VI	**Visualization, Guided Analysis and** Visualization: The Basics, Unconstrained Views, Guided Analysis: The Business Intelligence Two-Step, How to Guide the Guides, Handling Unstructured Data **(6 Hrs.)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Decision Support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Jay Aronson, David King	Pearson Education, 2009.	9th
2	The Savy Manager's Guide Getting Onboard with Emerging IT,	David Loshin, Business Intelligence	Morgan Kaufmann Publishers.	2009

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Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)

Course Code: MED391 Course: Open Elective-III Industry 4.0 **Teaching Scheme:** Theory: 3 Hrs./week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Objectives	1. To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment. 2. To give learners overview of Industry 4.0 technologies and their integration.
Unit I	**Introduction-** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. **(6 Hrs.)**
Unit II	**Internet of Things (IoT)–** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). **(6 Hrs.)**
Unit III	**Technologies in Industry 4.0 (1)-** Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. **(6 Hrs.)**
Unit IV	**Technologies in Industry 4.0 (2)-** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. **(6 Hrs.)**
Unit V	**Data in Industry 4.0-** Big Data, Data Mining, Data Analytics, Cloud computing, Data – anew resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. **(6 Hrs.)**
Unit VI	**Applications of Industry 4.0-** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0. **(6 Hrs.)**

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	Sr. No.	Title	Author	Publication	Edition
Textbook/ Reference Books	1	Industry 4.0 - the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	-
	2	Industry 4.0-Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer	1st
	3	Automated Manufacturing System	Hugh Jack	Lulu.com	7th
	4	Industry 4.0- Opportunities Behind The Challenge	Dr. Mirjana Stankovic, Ravi Gupta and Dr. Juan E. Figueroa	UNIDO General Conference 2017	-
	5	Handbook of Ind. Automation	Richard L. Shell Ernest L. Hall	CRC Press	1st

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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)

Course Code: MED392 Course: OE-III Operations Research **Teaching Scheme:** Theory: 3 Hrs/week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continues Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Objectives	1. To familiarize the students with formal quantitative approach to problem solving 2. To formulate real life engineering problems 3. To solve engineering problems using various Operations Research Techniques
Unit-I	**Introduction to Operations Research :** Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research. **(2 Hrs.)**
Unit-II	**Linear Programming Problem :** Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. **(8 Hrs.)**
Unit-III	**Transportation Model :** Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test – the stepping stone method or MODI method. Degeneracy in Transportation Problem. **(8 Hrs.)**
Unit-IV	**Assignment Problem:** Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. **(4 Hrs.)**
Unit-V	**Queuing model and Sequencing model :** Queuing Systems And Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population

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	Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. **(6 Hrs.)**
Unit-VI	**Network Models:** Fulkerson's rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network. **(8 Hrs.)**

Text Book/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Operations Research	Taha H.A.	Prentice Hall Of India.	Ninth Edition
2.	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	Seventh Edition
3.	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	Fourth Edition
4.	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12th Edition
5.	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	Second Edition
6.	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	Fourth edition
7.	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	Fourth Edition
8.	PERT and CPM: Principles and Applications	L. S. Srinath	East-West Press Private Limited,	Third Edition
9.	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Firewall Media	Fourth Edition

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Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE391	Credits: 03
Course: Open Elective III: Waste Management and Circular Economy	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs./week	Continuous Internal Evaluation: 10 Marks
	Teacher Assessment: 10 Marks
	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 2 Hrs.

Prerequisite	Plastic materials, processing, rheology, basics of polymer technology and designing
Objectives	• It aims to provide students with a comprehensive understanding of sustainable practices and the principles of the circular economy within the context of polymer engineering. • Students will explore various strategies, technologies, and policies for achieving sustainability, reducing environmental impact, and promoting circularity in the polymer industry. • The course will emphasize the importance of integrating sustainable principles in the design, production, and disposal of polymer materials.
Unit-I	**Topic Title: Introduction to Waste Management and Circular Economy** Definition and significance of sustainability in polymers, basics of waste management, principles and goals of the circular economy, environmental, social, and economic dimensions of waste management, life cycle thinking and assessment in plastics **(4 Hrs.)**
Unit-II	**Topic Title: Waste generation, composition, and management** Sources and types of plastic and polymer waste, composition analysis and characterization of waste, quantification and assessment of waste generation, waste management and treatment methods: MSWM processing and plastics waste management comprising of waste hierarchy i.e., prevention, minimization, reuse, recycling, energy recovery, and disposal. **(8 Hrs.)**

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Unit-III	**Topic Title: Sustainable Polymer Processing** Energy-efficient processing techniques, clean and green manufacturing practices, waste reduction and recycling in polymer processing, sustainable additives and processing aids **(6 Hrs.)**
Unit-IV	**Topic Title: Sustainable Waste Management and Disposal** Waste characterization and classification in polymers, mechanical recycling, waste-to-energy conversion technologies, biological treatment methods for polymer waste, hazardous waste management and regulations, sustainable landfilling and waste disposal practices **(6 Hrs.)**
Unit-V	**Topic Title: Circular Economy Strategies** Design for recycling and upcycling principles, closed-loop supply chains and reverse logistics, extended producer responsibility and product stewardship, circular economy business models and initiatives, case studies on successful implementation of circular economy strategies **(6 Hrs.)**
Unit-VI	**Topic Title: Policy and Regulatory Framework for Sustainability** International and national policies promoting sustainability in polymers, Environmental regulations and standards for the polymer industry, corporate social responsibility and sustainability reporting, challenges, and opportunities in implementing sustainable practices, future trends and emerging technologies in sustainable polymer engineering **(6 Hrs.)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Waste Management and the Circular Economy in Selected OECD Countries	OECD	OECD Publishing	1st Edition, 2019
2.	Plastics and Sustainability: Towards a Peaceful Coexistence	Michael Tolinski	Wiley	1st Edition 2011

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	between Bio-based and Fossil Fuel-based Plastics			
3.	Plastics and Sustainability: Towards a Deeper Understanding of the Environmental Role of Plastics in Today's World	Conor P Carlin	Wiley-Scrivener	1st Edition 2021
4.	Strategic Management for the Plastics Industry: Dealing with Globalization and Sustainability	Jones, Roger F.	CRC Press	1st Edition 2013
5.	Plastics in the Circular Economy	Vincent Voet, Jager, Rudy and Folkersma	De Gruyter	1st Edition 2023
6.	A Practical Guide to Plastics Sustainability: Concept, Solutions, and Implementation	Michel Biron	William Andrew Publishers	1st Edition, 2020
7.	Circular Economy and Waste Valorisation: Theory and Practice from an International Perspective	Jingzheng Ren, Long Zhang	Springer	1st Edition, 2022

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID371 Course: Lab-I Data Analytics and Modelling **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Objectives	Understand the basic concepts of Data analytics.
List of Practical	1. Implement Data cleaning using spreadsheets. 2. Analyze data using spreadsheets. 3. Create visualizations and dashboards with spreadsheets. 4. Perform fundamental data wrangling tasks that, together, form the pre-processing phase of data analysis. These tasks include handling missing values in data, formatting data to standardize it and make it consistent, normalizing data, grouping data values into bins, and converting categorical variables into numerical quantitative variables. 5. perform computations on the data to calculate basic descriptive statistical information and use the Pearson correlation method to compare two continuous numerical variables, use the Chi-square test to find the association between two categorical variables and how to interpret them. 6. Develop the model. a. define the explanatory variable and the response variable. b. evaluate a model using visualization. c. use the R-squared and the mean square error measures to perform in-sample evaluations to numerically evaluate the model. d. Implement Prediction and Decision Making to check the model accuracy 7. Model Evaluation a. identify overfitting and underfitting in a predictive model. b. using Ridge Regression to regularize and reduce standard errors to prevent overfitting a regression model c. use the Grid Search method to tune the hyperparameters of an estimator

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	8. Implement following probability distributions a. Binomial Distribution b. Poisson Distribution c. Normal Distribution 9. Collect and analyze sample data avoiding sampling bias and accurate estimates by using sampling distributions. 10. Mini Project

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester V	
Course Code: AID372 Course: Lab-II Artificial Neural Network and Deep Learning **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Objectives	1. Understand the fundamentals of Neural networks. 2. Understand the basic concepts of deep learning.
List of Practical	1. Implementation of different activation functions to train Neural Network. 2. Implementation of different Learning Rules. 3. Implementation of Perceptron Networks. 4. Implementation of Adeline network for system identification. 5. Implementation of Madeline network 6. Pattern matching using different rules. 7. Project related to application of machine learning in healthcare. 8. Project related to application of machine learning in business analysis. 9. Project related to application of machine learning in sports analytics. 10. Project related to application of machine learning in Time Series Analysis & Forecasting.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID373 Course: Lab-III Operating System **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 End Semester Examination/Oral: 25 Marks

Objectives	1. Student should be able to install windows or Linux OS. 2. Students should be able to simulate or implement resource management algorithms.
List of Practical	1. Installation of windows/Linux OS. 2. Hands on Unix/Linux basic commands. 3. Implementation of FCFS CPU scheduling algorithms. 4. Implementation of SJF CPU scheduling algorithms. 5. Implement producer consumer problem with bounded buffer solution with Semaphore. 6. Write a program illustrating various file handling functions. 7. Write a program for copying content of one file to other. 8. Implementation of various memory allocation algorithms, (First fit, best fit and Worst fit). 9. Implementation of FIFO page replacement algorithms. 10. Implementation of FCFS Disk Scheduling algorithm. 11. Case study: Red Hat Linux OS

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Syllabus of T. Y. B. Tech. (AIDS) Semester VI

Course Code: AID374 Course: Lab-IV Visualization Tools **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 End Semester Examination / Oral: 25 Marks

Objectives	1. Interpret the data by applying data visualization techniques. 2. Study different data visualization tools. 3. Develop an application using data visualization tools and techniques.
List of Practical	The laboratory work includes. 1 Introduction to Data Visualization and Data Visualization Tools 2 Create a diverse range of plots using Python(Matplotlib and Seaborn) and R Programming. 2.1 Area Plots 2.2 Histograms 2.3 Bar Charts 2.4 Pie Charts 2.5 Box Plots 2.6 Scatter Plots 3 Creating Dashboards with Plotly and Dash 3.1 Introduction to Plotly 3.2 Introduction to Dash 3.3 Make Dashboards Interactive 4 Data Visualization and Dashboards with Excel 4.1 Create basic visualizations such as line graphs, bar graphs, and pie charts using Excel spreadsheets. 4.2 Explain the important role charts play in telling a data-driven story. 4.3 Construct advanced charts and visualizations such as Treemaps, Sparklines, Histogram, Scatter Plots, and Filled Map Charts.

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	4.4 Build and share interactive dashboards using Excel 5 Fundamentals of Visualization with Tableau 5.1 Install Tableau Public Software and create a visualization 5.2 Examine and navigate the Tableau Public workspace 5.3 Practice and connect to different data sources 6 Visual Analytics with Tableau 6.1 Create a chart using Tableau 6.2 Create dates using calculated fields 6.3 Customize table calculations 6.4 Customize and create dual layer maps 7 Creating Dashboards and Storytelling with Tableau 7.1 Combine the data and follow the best practices to present your story 7.2 Create calculated fields for KPIs to build a figure that will be used to measure progress in the data 7.3 Assemble a dashboard 8 Introduction to Power BI 9 Data Visualization with Power BI 10 Mini Project

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(Faculty of Science & Technology) Syllabus of Third Year B. Tech. (All) Semester VI	
Course Code: AID375 Course: Lab-V Major Project-I **Teaching Scheme:** Practical: 4 Hrs./week	Credits: 2 Teachers Assessment: 25 Marks ESE/Oral: 25 Marks
Objectives	Solve a real life societal problem through research based approaches
Course Outcome	Upon the completion of this course the students will be expected to: 1. Formulate an analytical model for an engineering problem and obtain its solution with necessary tools. . 2. Perform and manage as an individual or as a member of a team with ethical values. 3. Examine the concepts of environment and sustainability 4. Write effective reports and communicate effectively on civil engineering problems. 5. Present the conclusions in a way to benefit the society.
Instructions to Students	Solving a real life problem should be the focus of under graduate projects. Faculty members should prepare project briefs (giving scope and references) well in advance which should be made available to the students at the departmental level. The project may be classified as hardware / software / modelling / simulation. It may comprise any elements such as analysis, design, synthesis, validation etc. Interdisciplinary/Multidisciplinary projects are encouraged.
Guidelines	The department will appoint a project coordinator who will coordinate the following. 1. Grouping of students (a maximum of 3/4 in a group) 2. Allotment of projects and project guides 3. Project monitoring at regular intervals. All projects allotments are to be completed as given in the Academic Calendar.

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	All projects will be monitored at least twice in a semester through students' presentation and will be conducted as per Academic Calendar. Distribution of marks for TA shall be as follows: Problem Statement 10; Literature Review 10; Group formation and identification of individual responsibility 10; Objective of Project activity 10; Knowledge of domain, technology and tools being used 10 **For TA 50 Marks to be converted to 25 Marks.** Distribution of marks for ESE/Oral shall be as follows: Realization of project as per problem statement 10; Design & Testing 30; Documentation and Report Writing 20; Quality of Work 15; Performance in Question & Answers Session 15; Timely Completion of Project work 10 **For ESE/Oral – 100 Marks to be converted to 25 Marks.** Efforts be made to carry out industry based/ Societal Projects. Problems can also be invited from the industries/Society to be worked out through undergraduate projects. In case of Interdisciplinary/Multidisciplinary Projects, as per the requirements, a greater number of Guides may be appointed. A Joint committee of involved departments shall conduct the review of the students. The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and conferences. The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated. Phases of Major Project - I: Phase I: Need Statement, Literature Review, data collection, Problem Statement, Objectives, Scope, Analysis/Framework/ Algorithm Phase II: Details of Hardware & Software, Methodology, and Implementation plan for next semester.

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	Phase III: Submission of report of project work.

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