Course Title	:	**Engineering Thermodynamics**	**Semester**	:	**IV**
Course Code	:	**24UME401T**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Basic Physics, Basic Mathematics and Fluid Mechanics

Course Objectives:

- To develop the understanding of thermodynamic principles/laws for ideal gas/pure substance and to use it for evaluation of the energy interaction with the thermodynamic systems undergoing process.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. To understand the basic concepts of thermodynamics, thermodynamics laws and thermodynamics processes
CO2. To understand the first law of thermodynamics, change in internal energy, heat transfer during thermodynamics processes and steady flow processes.
CO3. To understand the second law of thermodynamics, reversible and irreversible processes. Concept of entropy.
CO4. To understand properties of steam, dryness fraction, T-S diagram, Mollier chart. Concept of vapour cycles and air-standard cycle.

Course Content:

Unit I

8 Hrs.

Introduction To Thermodynamics: Basic Concepts of Thermodynamics, Zeroth Law of Thermodynamics, Heat and Work, Ideal Gas Laws, The Ideal Gas Equation of State, Internal Energy and Specific Heats of Gases, Universal Gas Constants.
Thermodynamic Processes: Constant Pressure, Constant Volume, Isothermal, Isentropic and Polytropic Process, Representation on P-V and T-S Diagram, Calculation of Heat Transfer, Work Done, Change in Internal Energy and Enthalpy for these processes

Unit II

7 Hrs.

First Law of Thermodynamics: Closed Systems, Work Done, Change in Internal Energy, Heat Transferred during various thermodynamic processes, P-V diagrams, Flow work and enthalpy, Application of Steady flow process

Unit III

7 Hrs.

Second Law of Thermodynamics: Introduction, Kelvin-Plank & Clausius statements, Heat engines, Refrigerator and Heat pump, Perpetual motion machines, Reversible and Irreversible processes, Carnot cycle, Thermodynamic temperature scale.

Entropy: The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed and Steady flow open systems

Unit IV

8 Hrs.

Properties of Steam: Formation of Steam, Application of Steam Table, Dryness fraction, Internal energy of steam, T-S diagram, Mollier chart. Work and Heat transfer during various Thermodynamics processes with steam as working fluid.

Vapour Cycles: Simple and Modified Rankine cycle with reheat & regeneration, Binary cycle.

Air-Standard Cycles: Otto, Diesel and Dual cycle. Brayton Cycle. (Analytical treatment in terms of calculation Work done & efficiency analysis is expected on Otto Cycle and Diesel Cycle)

Textbooks:

- Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill Publication.
- Thermodynamics- An Engineering Approach, Yunus A. Cenegel, Michael A. Boles, Tata McGraw-Hill Publication.
- Engineering Thermodynamics, R. K. Rajput, Laxmi Publication.

Reference Book:

- Thermodynamics, S. C. Gupta, Pearson Publications.
- Engineering Thermodynamics, Gordon Rogers, Pearson Publications
- Thermal Engineering, P. L. Ballani, Khanna Publications.
- Engineering Thermodynamics, S. S.Khandare, Charotar Publication House.
- Engineering Thermodynamics, D. P. Mishra, Cengage Learning Publications.

Course Title	:	**Fluid Mechanics & Hydraulic Machines**	**Semester**	:	**IV**
Course Code	:	**24UME402T**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **4 - 0 - 0**	**Total Credits**	:	**4**

Prerequisites:

- Basic Physics and Basic Mathematics

Course Objectives:

- Develop an understanding of fluid statics, kinematics and dynamics in Mechanical Engineering. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data and its dimensional analysis
- To develop the understanding of hydraulic machineries, its classification, principles, analysis and comparison between them. This course is to develop the knowledge application of hydraulic machines and its significance.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. To understand types and properties of fluid, to apply hydrostatic laws on submerged surfaces and analyze stability of floating body based on principles of buoyancy & flotation.
CO2. To learn various methods to measure pressure and evaluate the fluid flow kinematics for fluids in motion.
CO3. To understand formulate, analyze & apply basic principles of fluid dynamics and viscosity of fluid flow.
CO4. To understand the concepts of jet propulsion and velocity triangles. To learn the about hydraulic machines and understand the details about impulse turbine.
CO5. To understand the concept of reaction turbine, selection of hydraulic turbines, draft tube and cavitation of turbine.
CO6. To understand the concept of hydraulic pumps, design consideration of pumps and N.P.S.H.

Course Content:

Unit I

8 Hrs.

Fluid Properties :- Mass Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Surface Tension, Capillarity, Compressibility, Vapour Pressure Newton's law of Viscosity and its Applications (Numerical). Types of Fluids.
Hydro-static: Pascal's Law, Forces on submerged plane surfaces and curved surfaces (Numerical).
Buoyancy & Flotation: Principle of Flotation, Stability of floating and submerged bodies (Numerical).

Unit II

7 Hrs.

Fluid pressure & its Measurement, Manometers (Numerical) & Bourdon's pressure gauge.
Kinematics of Fluid Flow: Types of flow. Continuity equation in Cartesian Coordinates, Velocity and

Acceleration at a point (Numerical). Stream function & Velocity Potential function (Numerical), Stream line, Equi-potential lines, Path line, Streak line, Stream line, Flow net

Unit III

7 Hrs.

Dynamics of Fluid Flow: Linear Momentum Equation. Euler's Equation, Bernoulli's Equation. Applications of Bernoulli's Equation (Numerical): Venturi-meter, Orifice-meter, Pitot tube.
Viscous Flow: Introduction to laminar and turbulent flow, Reynolds number and its Significance. Boundary Layer Theory

Unit IV

8 Hrs.

Impact of Jet and Jet Propulsion: Momentum Principle, Dynamic action of jet on fixed & moving flat plates and curved vanes, Series of plates and vanes, Water Wheels, Velocity Triangles and their analysis.
Principles & Classification of Hydraulic Machines, Theory of turbo machines and their classification, Elements of Hydraulic Power Plant.
Impulse Turbines: Principle, Constructional details of Pelton Turbine, Velocity Diagram, Design Parameters

Unit V

7 Hrs.

Reaction Turbine: Principles of operation, Degree of reaction, Comparison over Pelton Turbine, Development of Reaction Turbines, Classification, Francis Turbine, Propeller Turbine, Kaplan Turbine Velocity diagram and analysis, Working proportions, Design parameters,
Performance characteristics, Governing of Pelton and Reaction Turbine, Selection of Hydraulic Turbines. Draft tubes, Cavitation in turbine.

Unit VI

7 Hrs.

Centrifugal pumps:- Principle of operation, Classification, Component of Centrifugal Pump installation, Priming, Fundamental Equation, Various Heads, Velocity triangles and their analysis or Effect of outlet blade angle, Vane Shapes, Losses and Efficiencies of Pumps, Multi staging of Pumps, Design Consideration, Working Proportions, N.P.S.H., Cavitation in pumps

Textbooks:

- Fluid Mechanics: Dr. R. K. Bansal, Lakshmi Publication (P) Ltd. New Delhi
- Fluid Mechanics: Yunus A. Cengel- Tata McGraw-Hill.
- Fluid Mechanics & Hydraulic Machines, R. K. Rajput, S. Chand & Company Ltd.

Reference Book:

- Thermodynamics, S. C. Gupta, Pearson Publications.
- Fluid Mechanic by Frank White and Henry Xue, McGraw-Hill.
- Fluid Mechanics for Engineers, P. N. Chatterjee – Macmillan India Ltd.

- Fluid Mechanics: J.F.Douglas, J.M. Gasiorek, J.A. Swaffield & Lynne B. Jack - Pearson Prentice Hall Pub.
- Fluid Mechanics Through Problems, by R.J. Garde, New Age International Private Limited Publishers

Course Title	:	**Hydraulic Machines**	**Semester**	:	**IV**
Course Code	:	**24UME402P**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **0 - 0 - 2**	**Total Credits**	:	**1**

Prerequisites:

- Basic knowledge of Fluid Mechanics

Course Objectives:

- To develop an understanding of hydraulic machinery. This course is to develop the knowledge of the application of hydraulic machineries

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Demonstrate the concept of Metacentric height, Bernaulli's apparatus through working model.
CO2. Demonstrate the concept of venture meter, orifice meter, Rotameter through working model.
CO3. Demonstrate the concept of Impulse and reaction turbines through working model.
CO4. Demonstrate the concept of various hydraulic pumps through working model

Course Content:

List of Experiments: (Perform any 8 – 10 Experiments)

1. To determine the metacentric height of a given floating vessel.
2. To verify Bernoulli's theorem.
3. To find the value of co-efficient of given venture meter fitted in a pipe.
4. To find the value of co-efficient of Discharge for a given orifice meter.
5. To measure the rate of flow of liquid using Rotameter.
6. Performance characteristics of Pelton wheel.
7. Performance characteristics of Francis Turbine.
8. Performance characteristics of Kaplan Turbine.
9. Performance characteristic of Variable Centrifugal speed pump
10. Performance characteristics of Reciprocating pump.
11. Performance characteristic of Axial Flow pump.

Course Title	:	**Dynamics of Machines**	**Semester**	:	**IV**
Course Code	:	**24UME403T**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Kinematics of Machinery or equivalent

Course Objectives:

- To introduce Students with the dynamics of rotating and energy absorbing components like gyroscopes.
- Make students understand the concepts of dynamics of the machines, effect of dynamic forces involved in various machine components, unbalances in the system due to these forces causing vibration and vibration control techniques.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Analyze the gyroscopic effects and determine the conditions for stability of ships, airplanes, and automobiles.
CO2. Analyze dynamic force in planer linkages and cams to determine required driving torque condition.
CO3. Analyze of balancing of rotating masses & reciprocating masses
CO4. Design Flywheel and analysis of Vibration

Course Content:

Unit I: Gyroscopic Effect

6 Hrs.

Introduction, precession motion, Effect of gyroscopic couple on shaft bearings, airplane, naval ship, vehicle stability

Unit II: Dynamic force analysis

6 Hrs.

Concepts in machine element dynamics. D'Alembert principle. Application of these approaches for equilibrium of mechanisms, Static and Dynamic force analysis of planar linkages such as four bar chain and reciprocating mechanism by graphical method. Cam dynamics and Jump-off phenomenon.

Unit III: Balancing of rotating and reciprocating masses

9 Hrs.

Introduction, Static and dynamic balancing, balancing of single revolving mass by balancing masses in same plane and in different planes, balancing of several masses revolving in the same plane, balancing of several masses revolving in different planes. [Graphical and analytical treatment]
Balancing of reciprocating masses in single and multi-cylinder engines, inline, radial and V type. Primary and secondary balancing analysis. Concept of direct and reverse crank. [Graphical and analytical treatment]

Unit IV: Flywheel & Vibration Analysis

9 Hrs.

Flywheel - Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, flywheel application in punching machines. [Analytical treatment]
Vibration Analysis: Types of vibration, method of vibration analysis of un-damped and damped free & forced vibration system. Whirling of shaft and critical speed of rotors

Textbooks:

- Thomas Bevan, "Theory of Machines," CBS Publishers & Distributors, 2005.
- W. L. Cleghorn, "Mechanisms of Machines," Oxford University Press, 2005.
- R. L. Norton, "Kinematics and Dynamics of Machinery," Tata McGraw Hill, 2009.
- A. Ghosh and A.K. Mallick, "Theory of Mechanisms and Machines," Affiliated East-West Pvt. Ltd, New Delhi, 1988

Reference Book:

- Theory of Machines and Mechanisms, J. E. Shigley and J. J. Uicker, Oxford University Press.
- Theory of Machines, Sadhu Singh, Pearson publications. 3. Advanced Mechanism Design–Analysis and Synthesis, A.G. Erdman, and G.N. Sandor, Vol. I and II, Prentice – Hall.
- "Mechanisms and Mechanical Devices Source Book", Neil Sclater, Nicholas P Chrironis, McGraw-Hill.
- Kinematics and Linkage Design, A. S. Hall, Jr., Prentice – Hall. 6. Mechanism Synthesis and Analysis, A. H. Soni, McGraw Hill

Course Title	:	**Dynamics of Machines Laboratory**	**Semester**	:	**IV**
Course Code	:	**24UME403P**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **0 - 0 - 2**	**Total Credits**	:	**1**

Prerequisites:

- Basic knowledge of Dynamics of Machines

Course Objectives:

- To study the dynamics of rotating and energy absorbing componentss.
- To understand the concepts of various machine components, unbalances in the system and vibration control techniques

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Demonstrate the concept of gyroscopic effect through the working model.
CO2. Analyze the performance of mechanisms and perform dynamic force analysis of linkages and cams.
CO3. Analyze balancing of rotating and reciprocating masses.
CO4. Demonstrate record and interpret data of vibration characteristics of mechanical vibratory systems and determine critical speed of shaft.

Course Content:

Any 08 experiments should be included in the Journal

8 Hrs.

1. Performance characteristics of Gyroscope.
2. Dynamic force analysis of four bar mechanisms
3. Performance analysis of quick return motion mechanism
4. Determination of jump speed of a cam follower mechanism
5. Balancing of rotating masses
6. Balancing of reciprocating mechanism
7. Determination of natural frequency of Free longitudinal vibration
8. Critical speed of shafts
9. Torsional vibration of single and two rotor system.
10. Performance on flywheel

Course Title	**:**	**Machine Learning**	**Semester**	**:**	**IV**
Course Code	**:**	**4UME404P**	**Course Category**	**:**	**SC-VSEC**
Teaching Scheme	**:**	**L - T - P** **0 - 0 - 4**	**Total Credits**	**:**	**2**

Prerequisites:

- Basic knowledge of mathematics, including algebra and calculus.
- Familiarity with analytical problem-solving techniques.
- Basic understanding of computer fundamentals.
- Basic knowledge of computers and computer systems

Course Objectives:

- Learn the basic concepts of how to use various AI techniques.
- Learn, realize, and implement various basic machine learning algorithms.
- Comprehend basic concepts of Neural network and use of machine learning for training

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Demonstrate proficiency in programming fundamentals, including variables, data types, control structures, and functions.
CO2. Apply algorithmic techniques to develop efficient solutions for a variety of engineering problems.
CO3. Utilize data structures such as arrays, lists, stacks, queues, trees, and graphs to organize and manipulate data effectively.
CO4. Employ numerical methods and simulation techniques to solve mathematical and engineering problems.

List of Experiments

Development of Python code for

1. Introduction to Python Programming
2. Data Structures in Python: Arrays, Lists, Stacks, Queues
3. Implementing Linear Regression (Univariate and Multivariate)
4. Gradient Descent Algorithm Implementation
5. Logistic Regression for Classification
6. K-Nearest Neighbors (KNN) for Classification
7. Decision Trees and Random Forests
8. Support Vector Machines (SVM) for Classification
9. Implementing Naive Bayes Classifier
10. L-Means Clustering for Unsupervised Learning
11. Principal Component Analysis (PCA) for Dimensionality Reduction
12. Implementing Neural Networks: Single-Layer Perceptron (SLP)

13. Multi-Layer Perceptron (MLP) with Backpropagation
14. Convolutional Neural Networks (CNNs) Basics
15. Recurrent Neural Networks (RNNs) for Time Series Prediction
16. Hyperparameter Tuning and Cross-Validation
17. Feature Selection and Engineering
18. Reinforcement Learning Basics
19. Time Series Analysis Using ARIMA
20. Model Evaluation and Comparison
21. Anomaly Detection in Sensor Data
22. Predictive Maintenance
23. Image-Based Quality Control
24. Vibration Analysis
25. Energy Efficiency Optimization
26. Robotics and Automation
27. Natural Language Processing for Technical Documents
28. Design Optimization
29. Material Science
30. Additive Manufacturing
31. Autonomous Systems
32. Human-Computer Interaction
33. Cybersecurity
34. Supply Chain Optimization
35. Environmental Monitoring
36. Biomedical Engineering
37. Smart Cities
38. Financial Engineering
39. Natural Language Processing for Technical Text
40. Explainable AI

Textbooks:

1. Machine Learning with Python for Everyone, Mark Fenner, Pearson, ISBN-10: 9353944902
2. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley, ISBN-10: 8126578513

3. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley, ISBN-10: 8126579900
4. Neural Networks, Fuzzy Logic, and Genetic Algorithms : Synthesis and Applications By S. Rajshekharan, G. A. Vijayalakshmi Pai, PHI, ISBN-10: 8120321863

Reference Books:

1. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International, ISBN-10: 0262133288
2. Tom Mitchell, Machine Learning, TMH, ISBN-10: 1259096955
3. Athem Ealpaydin, Introduction to Machine Learning, PHI, ISBN-10: 8120350782
4. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication, ISBN-10: 0470035617

Course Title	:	**Python programming**	**Semester**	:	**IV**
Course Code	:	**24UME405P**	**Course Category**	:	**PCC**
Teaching Scheme	:	**L - T - P** **0 - 0 – 2**	**Total Credits**	:	**1**

Prerequisites:

- Basic knowledge of mathematics, including algebra and calculus.
- Familiarity with analytical problem-solving techniques.
- Basic understanding of computer fundamentals.

Course Objectives:

- Introduce engineering students to programming as a problem-solving tool in various engineering domains.
- Develop proficiency in algorithmic thinking, program design, and implementation using a high-level programming language.
- Enable students to apply programming concepts and techniques to solve real-world engineering problems.
- Foster critical thinking and analytical skills through the development and analysis of algorithms.

Course Outcomes: Upon successful completion of the course, students should be able to:

- Demonstrate proficiency in programming fundamentals, including variables, data types, control structures, and functions.
- Apply algorithmic techniques to develop efficient solutions for a variety of engineering problems.
- Utilize data structures such as arrays, lists, stacks, queues, trees, and graphs to organize and manipulate data effectively.
- Employ numerical methods and simulation techniques to solve mathematical and engineering problems.

List of Experiments

1. Development of Python code for demonstration of array by Bubble sorting technique & Binary Searching
2. Development of Python code for solution of Numerical methods for algebraic equation of nth degree by Newton-Raphson Method
3. Development of Python code for solution of Numerical methods for algebraic equation of nth degree by False Position Method
4. Development of Python code for solution of Simultaneous equation by Gauss Elimination Method
5. Development of Python code for solution of Simultaneous equation by Gauss Jordan Method

6. Development of Python code for solution of Simultaneous equation by Gauss Seidal Method
7. Development of Python code for solution of First order Differential Equation by Taylor Series Method
8. Development of Python code for solution of First order Differential Equation by Runge-Kutta Method
9. Development of Python code for solution of First order Differential Equation by Eulers Method
10. Development of Python code for solution of First order Differential Equation by Eulers Modified Method
11. Development of Python code for solution of First order Differential Equation by Adams predictor-corrector Method
12. Development of Python code to calculate Eigen value & Eigen vector of any square matrix.
13. Development of Python code dealing with basic Heat Transfer
14. Development of Python code to calculate best fit curve, sensitivity, and deviation in output of an instrument.
15. Development of Python code to design knuckle joint.
16. Development of Python code to solve basic fluid Mechanics Numerical
17. Development of Python code to solve basic kinematics of machine problems.

Textbooks:

- "Python Programming: Problem Solving, Packages and Libraries", by Anurag Gupta, G.P. Biswas, McGraw-Hill Education, 2020, ISBN 10: 9353168015

Reference Book:

- "Python Programming" by Ashok Namdev Kamthane, Amit Ashok Kamthane, McGraw-Hill Education, 2018, ISBN 10: 9353160960
- "Let us Python" by Yashvant Kanetkar, Aditya Kanetkar, BPB Publication, ISBN 13: 9789389898521

Course Title	:	**Basics of Aircraft Propulsion**	**Semester**	:	**IV**
Course Code	:	**24UAE405T**	**Course Category**	:	**MC-MDM**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- NIL

Course Objectives:

- 1. To impart a fundamental understanding of various aircraft propulsion systems.
- 2. To develop the ability to analyse the performance of propulsion systems.
- 3. To instil the skills to design and optimise propulsion systems for specific applications.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Explain the working principles of different types of propulsion systems.
CO2. Apply thermodynamic principles to analyse the performance of propulsion systems.
CO3. Evaluate the performance of various propulsion components.
CO4. Design propulsion systems for specific aircraft applications, considering factors like performance, efficiency and environmental impact.

Course Content:

Unit I: Introduction to Propulsion Systems

8 Hrs.

Fundamental concepts of propulsion, Classification of propulsion systems like turbojet, turbofan, turboprop, ramjet and rocket, Basic thermodynamics of propulsion systems, Performance parameters: thrust, specific fuel consumption, thermal efficiency, propulsive efficiency, Current techniques and Development in aircraft propulsion technology.

Unit II: Thermodynamic Analysis of Propulsion Systems

7 Hrs.

Ideal and real cycles for gas turbine engines, Performance analysis of turbojet, turbofan and turboprop engines, Effects of component efficiencies on overall engine performance, Off-design performance analysis

Unit III: Propulsion System Components

7 Hrs.

Gas turbine engine components: compressor, turbine, combustor and nozzle, Component performance characteristics and limitations, Blade design and cooling techniques, Factors affecting component efficiency and durability

Unit IV: Propulsion System Design and Optimization

8 Hrs.

Design considerations for aircraft propulsion systems, Integration of propulsion system with aircraft airframe, Optimization techniques for propulsion system design, Environmental impact of aircraft

emissions and noise, Next-generation technologies in aircraft propulsion e.g. hybrid-electric, hydrogen-powered

Textbooks:

1. Mathur M.L. and Sharma, R.P., Gas Turbine, Jet and Rocket Propulsion, Standard Publishers.

2. V. Ganeshan, Elements of Gas Turbine.

3. Ethirajan Rathakrishnan, Gas Dynamics, Sixth Edition, PHI Learning private ltd.

Reference Books:

1. S. M. Yahya, Turbine, Compressors and Fans, Fourth edition, New age international publishers.

2. C. R Peterson and P. G. Hill, Mechanics and Thermodynamics of Propulsion, Pearson, 2009.

3. A. F. El-Sayed, Aircraft Propulsion and Gas Turbine Engines, CRC Press, 2008.

4. J. L. Kerrebrock, Aircraft Engines and Gas Turbines, MIT Press, 1992

Course Title	:	**Numerical Python and Pandas**	**Semester**	:	**IV**
Course Code	:	**24URO406T**	**Course Category**	:	**MC-MDM**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Basic knowledge of algebra, probability, statistics

Course Objectives:

- Explain the fundamental concepts and operations of Numerical Python (NumPy) and Pandas for data manipulation and analysis.
- Develop skills to create, manipulate, and perform operations on multidimensional arrays and Data Frames.
- Analyse datasets using statistical and visualization tools within NumPy and Pandas frameworks.
- Design efficient data processing workflows and solve real-world data problems.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Explain the core functionalities of NumPy and Pandas for data analysis tasks.
CO2. Implement multidimensional array operations and advanced indexing techniques.
CO3. Conduct exploratory data analysis (EDA) and derive insights from datasets.
CO4. Construct scalable and efficient data pipelines using Pandas and NumPy.

Course Content:

UNIT I- Introduction to Numerical Python (NumPy)

8 Hrs.

Overview of NumPy: Features, installation, and comparison with lists, Arrays in NumPy, Creating, accessing, slicing, and indexing, Operations on Arrays: Mathematical functions, broadcasting, and linear algebra, Advanced Topics: Reshaping, stacking, and vectorization, Applications in numerical computations

UNIT II- Data Handling with Pandas

7 Hrs.

Introduction to Pandas: Series and Data Frames, Creating and accessing data: Indexing, slicing, and filtering, Data Manipulation: Adding, deleting, and modifying rows/columns, Handling Missing Data: Methods to identify, fill, and drop missing values. Overview of Pandas data structures and key attributes

UNIT III- Data Processing and Analysis

7 Hrs.

Aggregations and Grouping: `group by()` and aggregation functions, Merging, Joining, and Concatenating DataFrames, Advanced Indexing Techniques: MultiIndex and hierarchical indexing, Time Series Data: Basics and operations. Data Visualization with Pandas: Line,

bar, and histogram plots.

UNIT IV- Exploratory Data Analysis (EDA)

8 Hrs.

Overview of EDA: Goals and key steps, Descriptive Statistics: describe(), correlation, and covariance, Cleaning and Transforming Data: String manipulation and reshaping, Data Visualization: Overview of Matplotlib/Seaborn integration, Real-World EDA Use Cases with NumPy and Pandas

Textbooks:

- Zelle, J. M., Python Programming: An Introduction to Computer Science. Franklin, Beedle & Associates Inc., 2017.
- Beazley, D., Python Cookbook: Recipes for Mastering Python 3. O'Reilly Media, Inc., 2013.

Reference Book:

- McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc., 2017
- Phillips, D. I., Python 3 Object-Oriented Programming: Build robust and maintainable software with object-oriented design patterns in Python 3. Packt Publishing Ltd., 2018.
- Grinberg, M., Flask Web Development: Developing Web Applications with Python. O'Reilly Media, Inc., 2018.

Course Title	:	**Automobile Engineering**	**Semester**	:	**IV**
Course Code	:	**24UOE451T**	**Course Category**	:	**MC-OE**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Elementary knowledge about automobiles.

Course Objectives:

- To develop the understanding of various Automobile System and Function of its Components.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. To understand the concepts of automobile, its components and power train.
CO2. To understand the concept of clutches and gear box of automobile.
CO3. To understand the concept of transmission system and brakes of automobile.
CO4. To understand the concept of steering system and suspension system of automobile.

Course Content:

Unit I

8 Hrs.

Introduction: Classification of Automobiles in detail, Major components, and their functions. Chassis Different vehicle layout and types of frames.
Power train: Engine, Basic Components, Classification, Two Stroke, Four Stroke, Petrol Engine, Diesel Engine.

Unit II

7 Hrs.

Clutch: Necessity, requirements of a clutch system. Types of Clutches and its functions.
Gear Box: Necessity of transmission, principle, types of transmission system, sliding mesh, constant mesh

Unit III

7 Hrs.

Transmission system: Propeller shaft, universal joint. Differential – Need and types. Rear axles and Front axles. Brakes: Need & types, mechanical, hydraulic & pneumatic brakes

Unit IV

8 Hrs.

Steering systems: Principle of steering, steering geometry and wheel alignment, power steering. Suspension systems: Function of spring and shock absorber

Textbooks:

- Automobile Engineering Vol. I & II, Kirpal Singh, Standard Publishers.
- Automobile Engineering, R.K.Rajput, Laxmi Publications.
- Automobile Engineering R.B. Gupta, Satya Prakashan New Delhi
- Course in Automobile Engineering, Sharma R. P, Dhanpat Rai and Sons.

Reference Book:

- Automotive Engines, Srinivasan S., Tata McGraw Hill.
- Automobile Engineering Vol. I, II & III, P. S. Gill, Kataria and Sons.
- Automobile Engineering, K.K. Jain, R.B. Asthana, Tata McGraw Hill.

Course Title	:	**Project evaluation and Management**	**Semester**	:	**IV**
Course Code	:	**24UOE452T**	**Course Category**	:	**MC-OE**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Student must be able goals and evaluating the viability of the project

Course Objectives:

- To develop an understanding towards a structured approach for every unique project undertaken in the industrial context about its need, concept, tools and techniques of project management approach.
- To develop working knowledge of the technical and financial aspects of project management decisions. Increase awareness and strengthen skills in applying participatory methods to project management.
- Understand the project management life cycle and be knowledgeable on the various phases from project initiation through closure.
- Develop detailed project plan to include: Defining a project's scope and tasks, estimating task resource needs, assessing project risk and response strategies, a communications plan, and more.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Utilize the use of a structured approach for each and every unique project undertaken including utilizing project management concepts, tools, and techniques.
CO2. Apply participatory methods to project management.
CO3. Do network scheduling and network planning
CO4. Manage lifecycle on the various phases from project initiation through closure.

Course Content:

Unit I

8 Hrs.

Definition & Characteristics of Project Performance Parameters: Time, Cost & Quality. Classification of Projects: Sector based, Investment based, Technology based, Cause based, Need based - Balancing, Modernization, Replacement, Expansion & Diversification. Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas. Governmental Framework for Identification of Opportunities, Incentives from state & central govt.; Import-substitution projects

Unit II

7 Hrs.

Project Conceptualization & Feasibility Analysis Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional Feasibility Study. Preparation of Project Feasibility Report & Specification; Aspects of Project Feasibility Managerial/Organization: Promoters Background, Criteria of Evaluation, Marketing/Commercial:

Demand & Supply, Competition, Market Survey, Porter's 5 Forces, Financial: Cost of Project, Means of Finance, Financial Projections – Profit & Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement, Schedule of Fixed Assets, Schedule of Term Loans

Unit III

7 Hrs.

Project Planning- Development of Project Network; Project Representation; Consistency and Redundancy in Project Networks; Project Scheduling- Basic Scheduling with AO-A Networks; Basic Scheduling with A-O-N Networks; Project Scheduling with Probabilistic Activity Times. Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Resource Leveling, Resource Smoothening, Project Crashing

Unit IV

8 Hrs.

Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates, Estimation of Manpower & Utilities. Project Budgeting & Control, Earned Value Management System: Concept of AC, PV, EV, Variances, etc. Contract Management: Responsibility Sharing Matrix, Types of Contract Payments, Risk Factors in Contracts – Contractor & Owner. Project Management Information System and Control, Management Pitfalls

Textbooks:

- Narendra Singh; Project Management & Control; Himalaya Publishing House, Mumbai
- S. Choudary, Project Management, Tata McGraw Hill
- Prasanna, C; Projects: Preparation, Appraisal, Budgeting & Implementation, Tata Mc-Graw Hill, New Delhi, (1987).
- Chas R.B., Aqulino, N.J. and Jacob,F.R., Production and Operations Management: manufacturing and services, Tata McGraw Hill, New Delhi (1999).

Reference Book:

- Maylor H, Project Management, Pearson Education Asia, New Delhi, (2009).
- Cleland D, Project Management, Tata Mc-GrawHill, New Delhi, (2007)

Course Title	:	**Project and Cost Management**	**Semester**	:	**IV**
Course Code	:	**24UOE453T**	**Course Category**	:	**MC-OE**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Student must know process of estimating, budgeting, and controlling costs.

Course Objectives:

- To provide an in-depth knowledge of the detailed procedures and documentation involved in cost ascertainment systems. To understand the concepts of Financial Management and its application for managerial decision making

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Understand the cost and management accounting techniques for evaluation, analysis and application in managerial decision making.
CO2. Compare and contrast marginal and absorption costing methods in respect of profit reporting.
CO3. Apply marginal and absorption costing approaches in job, batch, and process environments.
CO4. Prepare and interpret budgets and standard costs and variance statements.

Course Content:

Unit I

8 Hrs.

Introduction, Management Accounting - Definition, Objectives of Management Accounting, Role of Management Accounting in Management Process, Functions of Management Accounting, Significance of Management Accounting, Limitations of Management Accounting, Relationship between Management Accounting and Cost Accounting

Unit II

7 Hrs.

Sources of Finance, Financing organization, Types of Capital, Elements of Cost and Allocation of Indirect Expenses, Cost Control Break Even Analysis, Equipment Replacement Policy, Make or Buy Analysis.

Unit III

7 Hrs.

Recording of Transactions, Accounting Process, Journals, Cash Book, Ledger and Trial Balance sheet, Balance sheet, Profit and Loss Statement

Unit IV

8 Hrs.

Financial Ratio Analysis, Fund Flow Analysis, Cash Flow Analysis, Capital Budgeting-Nature and Significance, Techniques of capital Budgeting-Payback method, Accounting Rate of Return, Internal rate of return, Net present Value and Profitability Index

Textbooks:

- Financial Management by Dr. P C. Tulsian, S. Chand
- Management Accounting 10 edition, M N Arora

Reference Book:

- Management Accounting- Principles and Practice, R K Sharma and S.K Gupta
- Cost Accounting Principles and Practice, Narang Jain, PHI

Course Title	:	**Entrepreneurship and Startups**	**Semester**	:	**IV**
Course Code	:	**24UBS408T**	**Course Category**	:	**HSSM-EEMC**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Basic knowledge of business and finance

Course Objectives:

- The objective of the course is to create awareness among leaners about the various aspects of entrepreneurship development and that of start-ups.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Acquire basics of entrepreneurship development
CO2. Identify various types of startups.
CO3. Analyze the concept of ideation.
CO4. Develop knowledge of start-up funding.

Unit I

8 Hrs.

Concept of entrepreneurship, characteristics of an entrepreneur, types of Entrepreneurships, Functions of Entrepreneurs, Women entrepreneurship in India, Problems and challenges of women entrepreneurs, Government's support system to develop women entrepreneurship.

Unit II

7 Hrs.

Concept of startup, Features of start-up, challenges and benefits of startups, Types of startups: Scalable startup, small business startup, lifestyle startup, buyable startup, social startup, big business startup, causes of startup failure, Startup ecosystem

Unit III

7 Hrs.

Concept of ideation, ideation process, idea incubation, design thinking approach, ideation techniques: Brainstorming, Worst Idea, Mind Mapping, sketching, Analogies, SCAMPER, success factors for ideation

Unit IV

8 Hrs.

Funding for startups: Private equity fund, angel funding, venture funding, bootstrapping, crowd funding, Seed funding, government grants and subsidies, Successful start-up case studies

Reference Book:

- Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999.
- Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication.
- The startup checklist by David. S. Rose, Wiley publications, 2016.
- Trajectory: Start up: Ideation to Product/Market Fit by Dave Parker, Matt Holt Books
- Funding Your Startup By Dhruv Nath, Penguin Books India PVT Limited, 2020

Course Title	:	**Universal Human Values**	**Semester**	:	**IV**
Course Code	:	**24UBS411T**	**Course Category**	:	**VEC**
Teaching Scheme	:	**L - T - P** **2 - 0 - 0**	**Total Credits**	:	**2**

Prerequisites:

- Basic knowledge of ethical education and human values

Course Objectives:

- To instill moral and social values amongst learners.
- To strengthen self-reflection by sensitizing the learners about self, family, society and nature.
- To help learners develop a holistic perspective of life.

Course Outcomes: Upon successful completion of the course, students should be able to:

CO1. Analyze the essentials of value education and self-exploration.
CO2. Evaluate coexistence of the self with the body.
CO3. Develop sustained happiness through identifying the essentials of human values.
CO4. Identify the importance of harmony in family, society, and universal order.

Course Content:

Unit I

8 Hrs.

Value education, definition, need for value education. The content and the process of value education, basic guidelines for value education, self-exploration as a means of value education

Unit II

7 Hrs.

Concept of Swasthya and Sanyam, Harmony of self with body, coexistence of self and body, understanding the needs of self and the body, understanding the activities in the self and in the body

Unit III

7 Hrs.

Values in relationship - trust, respect, affection, care, guidance, reverence, glory, gratitude and love, the five dimensions of human endeavor – Siksha, Swasthya, Nyay, Utpadan and Vinimaya.

Unit IV

8 Hrs.

Basics for ethical human conduct, definitiveness in ethical human conduct, human rights violations and social disparities, concept of value based life and its importance

Activities:

1. Self-exploration through Johari Window Model.
2. Incorporating Self Development Plan.

Reference Book:

- A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
- Professional Ethics and Human Values, Premvir Kapoor, Khanna Book Publishing, New Delhi, 2019.
- Universal Human Values and Professional Ethics By Dr. Ritu Soryan, S.K. Katraia & Sons Publishing, 2022.
- Human Values & Professional Ethics by Dr. Gurudas Singh, Bhavya Books,3rd Edition 2002.
- Human Values in Education by N.L. Gupta, Concept Publishing Company, New Delhi, 2000
- Human Values and Professional Ethics by B.S. Raghavan, S. Chand Limited Publisher, 2009.