

MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belagavi)



Autonomous Programmes

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING



Master of Technology (M.Tech.)

in

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE (AI & DS)

SYLLABUS

I & II Semester (2024 - 26 Admitted Batch)

and

III & IV Semester (2024 - 26 Admitted Batch)

Academic Year 2024-25

SCHEME OF EVALUATION

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50 % of the maximum marks. Minimum passing marks in SEE is 50 % of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (Theory Course)

| Assessment | Marks |
|------------------------------------|-------|
| CIE 1 | 20 |
| CIE 2 | 20 |
| Activity decided by course faculty | 10 |
| SEE | 50 |
| Total | 100 |

SEMESTER END EXAMINATION

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have Six full questions.
3. Each full question is for 20 marks. There will be one full questions (with a maximum of four sub questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions.

| Examination | Maximum marks | Minimum marks to qualify |
|-------------|---------------|--------------------------|
| CIE | 50 | 25 |
| SEE | 50 | 25 |

Scheme & Syllabus

M.Tech. in Artificial Intelligence and Data Science

Academic Year 2024-25 (2024-26 Batch Students)

| I Semester | | | | | | | |
|--------------|-------------|--|--|-----------|-----------|---------------|---------------------|
| Course | Course Code | Course Title | Credits | | | Total Credits | Total Contact Hours |
| | | | L | P | SDA | | |
| BSS | 24MAI11 | Mathematics for AI and Data Science | 03 | 00 | 00 | 3 | 03 |
| IPCC | 24SAD12 | Fundamentals of Data Sciences | 03 | 02 | 00 | 4 | 04 |
| PCC | 24SAD13 | Artificial Intelligence and Machine Learning | 03 | 00 | 02 | 4 | 04 |
| PCC | 24SAD14 | Human-Computer Interaction | 02 | 00 | 02 | 3 | 03 |
| PCC | 24SAD15 | Problem Solving and Programming in Python | 02 | 02 | 00 | 3 | 03 |
| MCC | 24RMI16 | Research Methodology and IPR | 03 | 00 | 00 | 3 | 03 |
| PCCL | 24SAD17 | Term Paper 1 | 01 | 02 | 00 | 2 | -- |
| AUD | 24AUD18 | BOS recommended ONLINE courses | Classes and evaluation procedures are as per the policy of the online course providers | | | | |
| Total | | | 17 | 06 | 04 | 22 | 20 |

| II Semester | | | | | | | |
|-------------|-------------|-------------------------------------|--|----|-----|---------------|---------------------|
| Course | Course Code | Course Title | Credits | | | Total Credits | Total Contact Hours |
| | | | L | P | SDA | | |
| PCC | 24SAD21 | Advanced Database Management System | 02 | 00 | 02 | 3 | 04 |
| PCC | 24SAD22 | Deep Learning | 03 | 00 | 02 | 4 | 03 |
| PCC | 24SAD23 | Internet of Things and Applications | 03 | 00 | 02 | 4 | 04 |
| PEC | 24SAD22X | Professional Elective 1 | 02 | 00 | 02 | 3 | 03 |
| PEC | 24SAD23X | Professional Elective 2 | 02 | 00 | 02 | 3 | 03 |
| PEC | 24SAD24X | Professional Elective 3 | 03 | 00 | 00 | 3 | 03 |
| MPS | 24SAD26 | Mini Project with Seminar | 00 | 04 | 02 | 3 | -- |
| PCCL | 24SAD27 | Term Paper 2 | 01 | 02 | 00 | 2 | -- |
| AUD | 24AUD28 | BOS recommended ONLINE courses | Classes and evaluation procedures are as per the policy of the online course providers | | | | |
| Total | | | 16 | 06 | 12 | 25 | 20 |

| Professional Elective 1 | | Professional Elective 2 | | Professional Elective 3 | |
|-------------------------|---------------------------------------|-------------------------|--|-------------------------|--------------------------------------|
| Course Code | Course title | Course Code | Course title | Course Code | Course title |
| 24SAD221 | Cloud Computing | 24SAD231 | Virtual Reality | 24SAD241 | Image and Video Processing |
| 24SAD222 | Predictive Analysis | 24SAD232 | Blockchain Technology | 24SAD242 | Optimization Theories and Techniques |
| 24SAD223 | Data Visualization | 24SAD233 | Social Networking and Mining | 24SAD243 | Decision Support System |
| 24SAD224 | Data Security and Privacy | 24SAD234 | Pattern Recognition | 24SAD244 | Data and Web Mining |
| 24SAD225 | Logistics and Supply Chain Management | 24SAD235 | Artificial Intelligence and Cyber Security | 24SAD245 | Business Intelligence and Analytics |

Scheme & Syllabus for II Year

M.Tech. in Artificial Intelligence and Data Science

Academic Year 2024-25 (2023-25 Batch Students)

| III Semester | | | | | | | |
|--------------|-------------|-------------------------------------|------------------------|-----------|-----------|---------------|---------------------|
| Course | Course Code | Course Title | Credits | | | Total Credits | Total Contact Hours |
| | | | L | P | SDA | | |
| PCC | 23SAD31 | Internet of Things and Applications | 03 | 00 | 02 | 4 | 04 |
| PEC | 23SAD32X | Professional Elective 3 | 03 | 00 | 00 | 3 | 03 |
| PEC | 23SAD33X | Professional Elective 4 | 03 | 00 | 00 | 3 | 03 |
| PROJ | 23SAD34 | Project Work Phase - 1 | 00 | 06 | 00 | 3 | - |
| SP | 23SAD35 | Societal Project | 00 | 06 | 00 | 3 | - |
| INT | 23SAD36 | Internship | (06 weeks Internship) | | | 6 | - |
| Total | | | 9 | 12 | 02 | 22 | 10 |

| Professional Elective 3 | | Professional Elective 4 | |
|-------------------------|-------------------------------------|-------------------------|--|
| Course Code | Course title | Course Code | Course title |
| 23SAD321 | Image and Video Processing | 23SAD331 | Natural Language Processing |
| 23SAD322 | Optimization Theory and Techniques | 23SAD332 | Agile Technologies |
| 23SAD323 | Decision Support System | 23SAD333 | Computer Vision |
| 23SAD324 | Digital Marketing | 23SAD334 | Enterprise Resource Planning |
| 23SAD325 | Business Intelligence and Analytics | 23SAD335 | Software Project Planning & Management |

| IV Semester | | | | | | | | | |
|-------------|-------------|---------------------------|-------------------------|--------------------------|--------------------------|--------------|--------------|----------------|-----------|
| Course | Course Code | Course Title | Teaching hours per week | | Examination | | | | Credits |
| | | | Theory | Practical/ Field work | Durat ion in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | L | P | | | | | |
| PROJ | 23SAD41 | Project work phase - 2 | - | 08 | 03 | 100 | 100 | 200 | 18 |
| Total | | | - | 08 | 03 | 100 | 100 | 200 | 18 |

Note: Project Work Phase-2: Students in consultation with the guide/co-guide (if any) in the disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work on Project Work phase -1 to complete the Project work. Each student/batch of students shall prepare a project document and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25. SEE shall be at the end of the IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

| | | | |
|---------------------|--|---------------------|----------------|
| Course Title | Mathematics for AI and Data Science | | |
| Course Code | 24MAI11 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours / Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: Develop knowledge of testing of hypothesis using different tests conducted with real life

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Analyze the theory connected with magnification and rotation of images using linear transformation | 1, 2 | - |
| 2. | Compute orthogonal and orthonormal basis vectors required to analyze image and signal L2 & L3 processing problems | 1, 2 | - |
| 3. | Apply the technique of singular value decomposition for data compression & approximate the solution to solve inconsistent linear systems using least square approximation. | 1, 2,3 | - |
| 4. | Analyze probabilistic concepts required to test the hypothesis and take a decision using analysis of variance, T-test, F-test | 1, 2,3 | - |
| 5. | Analyze the problems/applications connected with random variable, random processes and able to solve the problems | 1, 2 | |

Course Contents:

| | |
|--|----------------|
| Module – 1 | 08 Hrs. |
| Vector Spaces: Vector spaces, sub-spaces, Linearly independent and dependent vectors, Basis and dimension, co-ordinate vectors - Illustrative examples. Linear transformations, Representation of transformations by matrices. | |
| Module – 2 | 08 Hrs. |
| Orthogonality and least squares: Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram Schmidt orthogonalization process. QR factorization, sofa matrices, least square problems, applications to linear models (least square lines and least square fitting of other curves). | |
| Module – 3 | 08 Hrs. |
| Eigen values and Eigen vectors, orthogonal diagonalization, Singular value decomposition, Principal Component Analysis- applications to image processing, | |
| Module – 4 | 08 Hrs. |
| Sampling theory: Population, Sample, Expectation, Variance, Standard deviation, Hypothesis: Null & Alternative hypothesis, testing of the hypothesis by Student's t-test, χ^2 test, F-test, Anova test. | |

| Module – 5 | 07 Hrs. |
|---|---------|
| <p>Introduction to single & pairs of random variables, operations on a single random variable, expected value of function of two random variables, moments, central moments, probability generating function, moment generating function, Regression analysis.</p> <p>Random processes, stationary and ergodic random processes, gaussian and poisson random processes. Introduction to Markow processes.</p> | |
| <p><u>Skill Development Activities Suggested:</u></p> <p>The students with the help of the course teacher can take up technical –activities that will enhance their skills understand their problems, or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.</p> <p>Activities: Jordam-Canonical form, Similarity transformation, Case studies of Random variables, Hypothesis Testing, Applications of Random process.</p> | |
| <p><u>TEXT BOOKS:</u></p> <ol style="list-style-type: none"> 1. David C. Lay, Steven R. Lay and J. J. McDonald, “Linear Algebra and its Applications”, Pearson Education Ltd, 5th Edition 2015. 2. Dr. B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 42nd Edition, 2012. 3. Probability, Statistics and Random Process T. Veerarajan Tata Mc-Graw Hill Co 3rd Edition. | |
| <p><u>REFERENCE BOOKS:</u></p> <ol style="list-style-type: none"> 1. Kreyzig, “Advanced Engineering Mathematics”. 2. “Probability & Random process” Academic press Elsevier, second edition, Scott Miller & Donald Childers. | |

| | |
|--------------|-------------------------------|
| Course Title | Fundamentals of Data Sciences |
|--------------|-------------------------------|

| | | | |
|--------------------|-----------------|--------------------|----------------|
| Course Code | 24SAD12 | L-P- SDA-C | 3-2-0-4 |
| Exam | 03 Hours | Hours/ Week | 04 |
| SEE | 50 Marks | Total hours | 50 |

Course objective: To provide students with a comprehensive understanding of data science concepts, techniques, and tools.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Explain and program data science, big data and fitting model | 1, 3, 5, 12 | |
| 2. | Explore data analysis, data science process, and R programs for the algorithms | 3 | - |
| 3. | Analyze the feature selection algorithms and recommendation systems | 1, 3, 12 | - |
| 4. | Design map reduce solutions | 5 | - |

Course Contents:

| Module - 1 | 8 Hrs. |
|--|--------|
| Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, A data Science Profile, Skill sets. Statistical Inference, Populations and samples, Big Data, new kinds of data, modelling, statistical modeling probability distributions, fitting a model, - Introduction to R. | |
| Module - 2 | 8 Hrs. |
| Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm). Algorithms, machine Learning Algorithms, Three Basic Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means, R Programs for the algorithms. | |
| Module - 3 | 8 Hrs. |
| Spam Filter, Linear Regression and Spam Filter, K-NN and spam Filter, Naïve Bayes Algorithm, Spam Filter using Naïve Bayes, Laplace Smoothing,, Comparing Naïve Bayes to K-NN, Scraping the Web, introduction to Logical Regression and M6D case study. | |
| Module - 4 | 8 Hrs. |
| Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. | |

| Module - 5 | 7 Hrs |
|--|-------|
| Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system. Data Engineering, Map reduce, Word Frequency Problem,, Map Reduce Solution, Other Examples of Map Reduce, Pregel - An Introduction. | |
| <p><u>Practical Component:</u></p> <p>Data Sets</p> <p>IRIS Data Set</p> <p>It is required that the student be conversant with R Programming Language or Python Programming language and use them in implementing Data Science and Algorithms.</p> <p>Iris is a particularly famous toy dataset (i.e. a dataset with a small number of rows and columns, mostly used for initial small-scale tests and proofs of concept). This specific dataset contains information about the Iris, a genus that includes 260-300 species of plants. The Iris dataset contains measurements for 150 Iris flowers, each belonging to one of three species: Virginica, Versicolor and Setose. (50 flowers for each of the three species). Each of the 150 flowers contained in the Iris dataset is represented by 5 values:</p> <ul style="list-style-type: none"> ➤ Sepal length, in cm ➤ Sepal width, in cm ➤ petal length, in cm ➤ petal width, in cm <p>Iris species, one of: iris-setose, iris-versicolor, iris-virginica. Each row of the dataset represents a distinct flower (as such, the dataset will have 150 rows). Each row then contains 5 values (4 measurements and a species label). The dataset is described in more detail on the UCI Machine Learning Repository website. The dataset can either be downloaded directly from there (iris.data file), or from a terminal, using the wget tool. The following command downloads the dataset from the original URL and stores it in a file named iris.csv. \$ wget "https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data" -O iris.csv</p> <p>MNIST Data Set</p> <p>The MNIST dataset is another particularly famous dataset as CSV file. It contains several thousands of handwritten digits (0 to 9). Each hand-written digit is contained in a 28×28 8-bit grayscale image. This means that each digit has 784 (282) pixels, and each pixel has a value that ranges from 0 (black) to 255 (white). The dataset can be downloaded from the following URL: https://raw.githubusercontent.com/dbdmg/data-science-lab/master/datasets/mnist_test.csv.</p> <p>Each row of the MNIST datasets represents a digit. For the sake of simplicity, this dataset contains only a small fraction (10,000 digits out of 70,000) of the real MNIST dataset, which is known as the MNIST test set. For each digit, 785 values are available</p> | |

| | |
|---|---|
| .Sl. No. | Experiments |
| 1. | Load the Iris dataset as a list of lists (each of the 150 lists should have 5 elements). Compute and print the mean and the standard deviation for each of the 4 measurement columns (i.e. sepal length and width, petal length and width). Compute and print the mean and the standard deviation for each of the 4 measurement columns, separately for each of the three Iris species (Versicolor, Virginica and Setose). Which measurement would you consider “best”, if you were to guess the Iris species based only on those four values? |
| 2. | <p>Load the MNIST dataset. Create a function that, given a position $1 \leq k \leq 10,000$, prints the kth digit of the dataset (i.e. the kth throw of the csv file) as a grid of 28×28 characters. More specifically, you should map each range of pixel values to the following characters:</p> <ul style="list-style-type: none"> ➤ $[0, 64) \rightarrow " "$ ➤ $[64, 128) \rightarrow "."$ ➤ $[128, 192) \rightarrow "*"$ ➤ $[192, 256) \rightarrow "#"$ <p>Compute the Euclidean distance between each pair of the 784-dimensional vectors of the digits at the following positions: 26th, 30th, 32nd, 35th. Based on the distances computed in the previous step and knowing that the digits listed are 7, 0, 1, 1, can you assign the correct label to each of the digits ?</p> |
| 3. | <p>Split the Iris dataset into two the datasets - Iris Test_Train Data.csv, IrisTest_TestData.csv. Read them as two separate data frames named Train_ Data and Test Data respectively. Answer the following questions:</p> <ul style="list-style-type: none"> ➤ How many missing values are there in Train_Data? ➤ What is the proportion of Setosa types in the Test_Data? ➤ What is the accuracy score of the K-Nearest Neighbor model (model_1) with 2/3 neighbors using Train_Data and Test_Data? ➤ Identify the list of indices of misclassified samples from the “model_1”. ➤ Build a logistic regression model (model_2) keeping the modelling steps constant. Find the accuracy of the model_2. |
| 4. | Demonstrate Decision tree classification model and Evaluate the performance of classifier on Iris dataset. |
| 5. | Demonstrate any of the Clustering model and Evaluate the performance on Iris dataset. |
| <u>TEXT BOOKS:</u> <ol style="list-style-type: none"> 1. Cathy O Neil, Rachel Schutt, 2014, “Doing Data Science-Straight Talk from the Frontline”, Orielly. 2. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, 2014 Mining of Massive Data Sets, Cambridge University Press. | |
| <u>REFERENCE BOOKS:</u> <ol style="list-style-type: none"> 1. Kevin Murphy, 2013, Machine learning: A Probabalistic Perspective. 2. Peter Bruce, Andre Bruce, Practical Statistics for Data Scientists, Orielly Series | |

| | | | |
|---------------------|---|--------------------|----------------|
| Course Title | Artificial Intelligence and Machine Learning | | |
| Course Code | 24SAD13 | L-P- SDA-C | 3-0-2-4 |
| Exam | 03 Hours | Hours/ Week | 04 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with a comprehensive understanding of key concepts and techniques in artificial intelligence (AI), problem-solving agents, search strategies, knowledge representation, and machine learning.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|-------------------|-----------------|
| 1. | Analyze AI problems, design problem-solving agents, and apply search strategies and constraint satisfaction techniques for efficient problem-solving | 1, 2, 3, 4, 8, 12 | - |
| 2. | Employ advanced search algorithms, apply knowledge representation and reasoning techniques, and design intelligent systems for solving complex AI problems | 1, 2, 3, 4, 8, 12 | - |
| 3. | Apply machine learning techniques, perform data preparation, and design effective machine learning systems for real-world applications | 1, 2, 3, 4, 8, 12 | - |
| 4. | Apply regression, classification, unsupervised learning, and reinforcement learning techniques for solving real-world problems and evaluate their performance | 1, 2, 3, 4, 8, 12 | - |

Course Contents:

| | |
|---|---------------|
| Module –1 | 8 Hrs. |
| Introduction: AI problems, Agents and Environments, Structure of Agents, Problem-Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-FirstSearch, Depth-first with Iterative Deepening), | |
| Module –2 | 8 Hrs. |
| Heuristic Search (Hill Climbing, Generic Best-First,A*), Constraint Satisfaction (Backtracking, Local Search). Advanced Search: Constructing Search Trees, Stochastic Search, AO* Search Implementation,Minimax Search, Alpha-Beta Pruning | |
| Module – 3 | 8 Hrs. |
| Basic Knowledge Representation and Reasoning:Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction toProbabilistic Reasoning, Bayes Theorem. | |
| Module –4 | 8 Hrs. |
| Machine Learning: Introduction. Machine Learning Systems, Forms of Learning: Supervised and Unsupervised Learning, reinforcement – theory of learning – feasibility of learning – Data Preparation– training versus testing and split | |

| | |
|---|---------------|
| .Supervised Learning:Regression: Linear Regression, multi-linear regression, Polynomial Regression, logisticregression, Non-linear Regression, Model evaluation methods. | |
| Module –5 | 7 Hrs. |
| Classification: Support vector machines (SVM), Naïve Bayes classification. Unsupervised learning: Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees, Clustering trees – learning ordered rule lists – learning unordered rule. Reinforcement learning- Example: Getting Lost -State and Action Spaces. | |
| <u>Skill Development Activities Suggested:</u> The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks. | |
| <u>TEXT BOOKS:</u> <ol style="list-style-type: none"> 1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010. 2. MACHINE LEARNING An Algorithmic Perspective 2nd Edition, Stephen Marsland, 2015, by Taylor & Francis Group, LLC. 3. Introduction to Machine Learning, The Wikipedia Guide. | |
| <u>REFERENCE BOOKS:</u> <ol style="list-style-type: none"> 1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009. 2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009. 3. Introduction to Machine Learning, Second Edition, Ethem Alpaydın, the MIT Press, Cambridge, Massachusetts, London, England. 4. Machine Learning, Tom M. Mitchell, McGraw-Hill Science, ISBN: 0070428077. 5. Understanding Machine Learning: From Theory to Algorithms, c 2014 by Shai Shalev-Shwartz and Shai Ben-David, Published 2014 by Cambridge University Press. | |

| Course Title | Human-Computer Interaction | | |
|--------------|----------------------------|-------------|---------|
| Course Code | 24SAD14 | L-P-SDA-C | 2-0-2-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with a comprehensive understanding of user interface design principles, including the importance of good design, characteristics of graphical and web interfaces, the design process, usability considerations, selecting appropriate controls, providing effective feedback and guidance, and considering internationalization, accessibility, graphics, icons, images, and colors for creating user-friendly interfaces.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Demonstrate a comprehensive understanding of user interface design, and apply principles to create intuitive and user-friendly interfaces | 1, 2, 3, 5, 11 | - |
| 2. | Apply critical thinking skills to effectively navigate the user interface design process by identifying and overcoming obstacles and pitfalls | 1, 2, 3, 5 | - |
| 3. | Demonstrate the ability to effectively apply device and screen based controls in user interface design | 1, 2, 3, 5 | - |
| 4. | Apply effective feedback, guidance, and assistance techniques in user interface design | 1, 2, 3, 5 | - |

Course Contents:

| Module – 1 | 8 Hrs. |
|---|--------|
| The User Interface: Introduction, Importance of the User Interface, Importance and Benefits of Good Design History of Human-Computer Interface. Characteristics of Graphical and Web User Interface: Graphical User Interface, popularity of graphics, concepts of Direct Manipulation, Graphical System advantages and disadvantages, Characteristics of GUI. | |
| Module – 2 | 8 Hrs. |
| Web User Interface, the popularity of Web, Characteristics of Web Interface, Merging of Graphical BusinessSystems & the Web, Principles of User Interface Design. The User Interface Design Process: Obstacles and Pitfall in the development Process, Usability, The Design Team, Human Interaction with Computers, | |
| Module – 3 | 8 Hrs. |
| Important Human Characteristics in Design, Human Consideration in Design, Human Interaction Speeds, Performance versus Preference, Methods for Gaining and Understanding of Users. Device and Screen-Based Control: Device based controls, Operable Controls, Text entry/read- Only Controls, | |

| | |
|---|---------------|
| Module – 4 | 8 Hrs. |
| Device and Screen-Based Control: (Continued)Section Controls, Combining Entry/Selection Controls, Other Operable Controls and Presentation Controls, Selecting proper controls. Effective Feedback Guidance and Assistance: Providing the Proper Feedback, Guidance and Assistance | |
| Module-5 | 7 Hrs |
| Effective Internationalization and Accessibility- International consideration, Accessibility, Create meaningful Graphics, Icons and Images, Colors-uses, possible problems with colours, choosing colors. | |
| <u>Skill Development Activities Suggested:</u> <p>The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.</p> | |
| <u>TEXT BOOKS:</u> <ol style="list-style-type: none"> 1. Fundamentals of Human Computer Interaction, Andrew Monk 1st Edition. 2. The Essential Guide to User Interface Design, Wilbert O. Galitz ,Wiley , Indian Edition. | |
| <u>REFERENCE BOOKS:</u> <ol style="list-style-type: none"> 1. Designing the user interfaces, Ben Shneidermann, Pearson Education Asia 3 rd Edition. 2. User Interface Design, Soren Lauesen, Pearson Education. 3. Essentials of Interaction Design, Alan Cooper, Robert Riemann, David Cronin Wiley. 4. Human Computer Interaction, Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell, Bealg Pearson Education | |

| | | | |
|---------------------|--|---------------------|----------------|
| Course Title | Problem Solving and Programming in Python | | |
| Course Code | 24SAD15 | L-P- SDA-C | 2-2-0-3 |
| Exam | 03 Hours | Hours / Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide learners with a comprehensive understanding of Python programming language and its core concepts.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|-------------------|-----------------|
| 1. | apply Python syntax and operators, make decisions and implement loops, and effectively write Python code | 1, 2, 3, 4, 5, 12 | - |
| 2. | apply Python collections and sequences and create user-defined functions with parameters and optional arguments | 1, 2, 3, 4, 5, 12 | - |
| 3. | utilize Python modules effectively, import and explore module attributes, perform file handling operations and utilize file processing functions from the OS module | 1, 2, 3, 4, 5, 12 | - |
| 4. | implement object-oriented programming concepts, utilize regular expressions for pattern matching and manipulation, and effectively handle errors and exceptions in Python | 1, 2, 3, 4, 5, 12 | - |

Course Contents:

| Module – 1 | 8 Hrs. |
|--|--------|
| Introduction to Python: History of Python, Strengths and weaknesses, Different Versions, Installing Python, Setting up in the local environment, IDLE, Executing from a file, command line from interactive mode, Python Identifiers, and reserved keywords. Python syntax: Variables and Variables type, Data types, Data Types Conversion, Operators (Arithmetic, Comparison, Assignment, Bitwise, Logical, Membership, Identity), Operators Precedence, Python Decision making (if, el if, else, nested if), Python loops (while, for, nested loops), Break and continue statements. | |
| Module – 2 | 8 Hrs. |
| Python Collections or Sequence: Sequence introduction, Number operations, String Operations Manipulating Strings: Working with Strings, Useful String Methods. Lists: The List Data Type, Working with Lists, Tuples, Dictionaries and Set. | |
| Module – 3 | 8 Hrs. |
| Python Functions: Function introduction, User defined functions, Function with parameters, Key words, and optional parameters, Scope of variables (Global and Local), Anonymous function– Lambda, In-built function List comprehension. Python Modules: Modules, Standard Modules (Sys, Math, Time), Import Statement, from statement Dir() functions. | |
| Module – 4 | 8 Hrs. |
| Python File Handling: Sending Output to STDOUT Using the print() Method, Reading Input | |

| | |
|---|--------------|
| <p>with the input() Method, Creating File Objects with the open() Method, Controlling File Access Modes, Working with File Object Attributes, Closing File Objects with the close() Method, Reading and Writing to File</p> <p>Objects with read () and write (), Using File Processing Functions from the OS Module.</p> <p>OOP: Class and object, Attributes, Inheritance, Overloading, Overriding, Polymorphism, Iterators and Generators, Decorators, Static and Class Methods, Meta Classes</p> | |
| Module – 5 | 7 Hrs |
| <p>Regular Expressions: Introduction, Simple Character Matches, Special Characters, Files I/O, Exceptions, Match function, Search function, Matching v/s Searching, Modifiers, Patterns.</p> <p>Exception handling: Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Raise, Writing Your Own Exception Classes.</p> | |
| <p><u>Practical Component:</u></p> <ol style="list-style-type: none"> 1. Compute the GCD of two numbers. 2. Find the square root of a number. (Newton's method) 3. Exponentiation. (power of a number) 4. Find the maximum of a list of numbers. 5. Linear search and Binary search. 6. Selection sort, Insertion sort. 7. How to create, slice, change, delete and index elements using Tuple. 8. Find First n prime numbers. 9. How to create, slice, change, add, delete and index elements using list. 10. Programs that take command line arguments (word count) 11. Write a program to reverse the string. 12. How to change, delete, add and remove elements in Dictionary. 13. Find the most frequent words in a text read from a file. 14. Simulate elliptical orbits in Pygame. 15. Simulate the bouncing ball using Pygame. | |
| <p><u>TEXT BOOKS:</u></p> <ol style="list-style-type: none"> 1. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming- An Introduction to Computer Science Using Python 3.6, Shroff Publications and Distributors. | |
| <p><u>REFERENCE BOOKS:</u></p> <ol style="list-style-type: none"> 1. John V Guttag, Introduction to Computation and Programming Using Python“, Revised and Expanded Edition, MIT Press, 2013. 2. Robert Sedgewick, Kevin Wayne, Robert Dondero, - Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016. 3. Timothy A. Budd, Exploring Python, McGraw Hill Education (India) Private Ltd., 2015. 4. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013. 5. Rossum, Introduction To Python, Shroff Publications and Distributors. 6. Downey, Think Python 2/ED, Shroff Publications and Distributors. 7. Lutz, Learning Python, 5/ED, Shroff Publications and Distributors. 8. Campbell, Practical Programming: An Introduction to Computer Science Using Python, Shroff Publications and Distributors. | |

| | |
|---------------------|-------------------------------------|
| Course Title | Research Methodology and IPR |
|---------------------|-------------------------------------|

| | | | |
|--------------------|-----------------|---------------------|----------------|
| Course Code | 24RMI16 | L-P- SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours / Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To give an overview of technical research activities and patenting methodology.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Conduct research independently | 2, 4, 12 | - |
| 2. | Choose research designs, sampling designs, measurement and scaling techniques, and also different methods of data collections | 2, 3, 12 | - |
| 3. | Statistically interpret the data and draw inferences | 4, 5, 12 | - |

Course Contents:

| Module –1 | 8 Hrs. |
|---|--------|
| Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. | |
| Module –2 | 8 Hrs. |
| Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. | |
| Module – 3 | 8 Hrs. |
| Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. | |
| Module – 4 | 8 Hrs. |

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, and Cautions in Using Chi-Square Tests. **Intellectual Property:** The Concept, Intellectual Property System in India, Types of IPR.

Module – 5

7 Hrs.

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Types of IPR.

TEXT BOOKS:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture,” PHI, 6th Edition.
3. Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.

REFERENCE BOOKS:

1. Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
2. Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

- https://www.youtube.com/watch?v=A7oioOJ4g0Y&list=PLVf5enqoJ-yVQ2RXU16mCfLPf3J_JUfoc

| Course Title | Term Paper 1 | | |
|--------------|--------------|-------------|---------|
| Course Code | 24SAD17 | L-P-SDA-C | 1-2-0-2 |
| Exam | 03 Hours | Hours/ Week | -- |
| CIE | 100 Marks | Total hours | -- |

Course objective: To provide students with an opportunity to delve into a specific topic within the field of AI and data science, conduct independent research, and demonstrate their understanding and analytical skills.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|-------------------------|-----------------|
| 1. | Develop advanced research and analytical skills for further study, research, and professional work in the field of artificial intelligence and data science | 1, 2, 3, 4, 5, 8, 9, 12 | - |

Course Contents:

- The term paper is an integral part of the course and provides students with an opportunity to investigate a specific topic within the discipline. Here are some important considerations regarding Term Paper 1:
- The primary objective of Term Paper 1 is to provide students with the opportunity to conduct autonomous research, delve into a specific area of interest, and demonstrate their comprehension of AI and data science concepts.
- Students are typically permitted to select an AI and data science-related topic that corresponds with their interests and academic objectives. The subject must be well-defined, specific, and pertinent to the course material.
- Students are expected to conduct an exhaustive investigation in order to collect pertinent data, scholarly articles, research papers, and case studies pertinent to their chosen topic. They should evaluate the gathered data critically and draw meaningful conclusions.
- Students are encouraged to demonstrate originality and creativity in their term papers while building on prior knowledge. This may involve proposing new approaches, addressing emerging challenges, or recommending innovative solutions within their selected subject area.
- Depending on the nature of the topic, students may use a variety of research methodologies or examine authentic datasets. It is essential to explicitly describe the methodology employed and justify its selection.
- The term paper should have a distinct introduction, a coherent body, and a succinct conclusion. To improve intelligibility, students should maintain a logical flow and provide appropriate transitions between sections.
- It is essential to properly cite all sources consulted throughout the research process. Students must use the recommended citation style (e.g., APA, MLA) and provide a complete inventory of references at the conclusion of their papers.

- **Writing and Presentation Skills:** The term paper requires effective communication. Students should ensure that their writing is concise, plain, and error-free. In addition, they may be required to present and defend their term paper, demonstrating their presentation and public speaking skills.
- Throughout the term paper, students must adhere to academic integrity principles. Plagiarism and other forms of intellectual dishonesty are strictly prohibited and carry severe repercussions.
- The term paper will be evaluated based on the faculty's provided criteria. Research profundity, critical analysis, clarity of writing, originality, and adherence to guidelines may be considered when assigning a grade.

SCHEME FOR TERM PAPER 1 EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|----------------|--|------------------------------|
| 1. | Topic selection, Organization, and Clarity | 10 |
| 2. | Literature Review and Research Methodology | 20 |
| 3. | Findings and Analysis | 30 |
| 4. | Discussion and Conclusion | 20 |
| 5. | Presentation | 20 |
| Total | | 100 |

| | |
|---------------------|---------------------------------------|
| Course Title | BOS recommended ONLINE courses |
|---------------------|---------------------------------------|

| | | | |
|--------------------|----------------|---------------------|---------------------|
| Course Code | 24AUD18 | L-P- SDA-C | Audit Course |
| Exam | - | Hours / Week | - |
| SEE | - | Total hours | - |

➤ **Audit Courses/ Ability Enhancement Courses Suggested by BOS (ONLINE courses)**

➤ **Audit Courses:**

- These are prerequisite courses suggested by the concerned Board of Studies.
- Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs.

➤ **Ability Enhancement Courses:**

- These courses are prescribed to help students enhance their skills in fields connected to the field of specialization as well as allied fields that lead to employable skills. Involving in learning such courses is the impetus for lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to the Audit/Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Scheme & Syllabus for II Year

M.Tech. in Artificial Intelligence and Data Science

Academic Year 2024-25

| III Semester | | | | | | | |
|--------------|-------------|-------------------------------------|------------------------|-----------|-----------|---------------|---------------------|
| Course | Course Code | Course Title | Credits | | | Total Credits | Total Contact Hours |
| | | | L | P | SDA | | |
| PCC | 23SAD31 | Internet of Things and Applications | 03 | 00 | 02 | 4 | 04 |
| PEC | 23SAD32X | Professional Elective 3 | 03 | 00 | 00 | 3 | 03 |
| PEC | 23SAD33X | Professional Elective 4 | 03 | 00 | 00 | 3 | 03 |
| PROJ | 23SAD34 | Project Work Phase - 1 | 00 | 06 | 00 | 3 | - |
| SP | 23SAD35 | Societal Project | 00 | 06 | 00 | 3 | - |
| INT | 23SAD36 | Internship | (06 weeks Internship) | | | 6 | - |
| Total | | | 9 | 12 | 02 | 22 | 10 |

| Professional Elective 3 | | Professional Elective 4 | |
|-------------------------|-------------------------------------|-------------------------|--|
| Course Code | Course title | Course Code | Course title |
| 23SAD321 | Image and Video Processing | 23SAD331 | Natural Language Processing |
| 23SAD322 | Optimization Theory and Techniques | 23SAD332 | Agile Technologies |
| 23SAD323 | Decision Support System | 23SAD333 | Computer Vision |
| 23SAD324 | Digital Marketing | 23SAD334 | Enterprise Resource Planning |
| 23SAD325 | Business Intelligence and Analytics | 23SAD335 | Software Project Planning & Management |

| IV Semester | | | | | | | | | |
|-------------|-------------|---------------------------|-------------------------|--------------------------|--------------------------|--------------|--------------|----------------|-----------|
| Course | Course Code | Course Title | Teaching hours per week | | Examination | | | | Credits |
| | | | Theory | Practical/ Field work | Durat ion in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | L | P | | | | | |
| PROJ | 23SAD41 | Project work phase - 2 | - | 08 | 03 | 100 | 100 | 200 | 18 |
| Total | | | - | 08 | 03 | 100 | 100 | 200 | 18 |

Note: Project Work Phase-2: Students in consultation with the guide/co-guide (if any) in the disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work on Project Work phase -1 to complete the Project work. Each student/batch of students shall prepare a project document and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25. SEE shall be at the end of the IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

| Course Title | Internet of Things and Applications | | |
|--------------|-------------------------------------|-------------|---------|
| Course Code | 23SAD31 | L-P-SDA-C | 3-0-2-4 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: Students will explore schemes for the applications of IOT in real time scenarios , examine the potential business opportunities that IoT can uncover, explore the models of Internet of things to business, Identify different case studies to understand how IoT works.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Develop schemes for the applications of IOT in real time scenarios | 1,2,3 | - |
| 2. | Manage the Internet resources | 2 | - |
| 3. | Model the Internet of things to business | 1,2,3 | - |
| 4. | Work with different case studies with the practical knowledge gained. | 4 | - |

Course Contents:

| Module – 1 | 08 Hrs. |
|---|---------|
| What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over. The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications. | |
| Module – 2 | 08 Hrs. |
| Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF Ipv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO | |
| Module – 3 | 08 Hrs. |

| | |
|--|----------------|
| Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: Ipv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, Ipv6 Protocol Overview, Ipv6 Tunnelling, Ipv6 in Ipv6, Header Compression Schemes, Quality of Service in Ipv6, Migration Strategies to Ipv6. | |
| Module – 4 | 08 Hrs. |
| Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications. | |
| Module – 5 | 07 Hrs. |
| Data Analytics for IoT – Introduction, Apache Hadoop, Using HadoopMapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study. | |
| <u>Skill Development Activities Suggested:</u> The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks. | |
| <u>Text Books:</u> <ol style="list-style-type: none"> 1. Building the Internet of Things with Ipv6 and MIPv6: The Evolving World of M2M Communications Daniel Minoli Wiley 2013 2. Internet of Things: A Hands-on Approach Arshdeep Bahga, Vijay Madisetti Universities Press 2015 Reference Books: | |
| <u>Reference Books:</u> <ol style="list-style-type: none"> 1. The Internet of Things Michael Miller Pearson 2015 First Edition 2. Designing Connected Products Claire Rowland, Elizabeth Goodman et.al O'Reilly First Edition, 2015.. | |

| Course Title | Image And Video Processing | | |
|--------------|----------------------------|-------------|---------|
| Course Code | 23SAD321 | L-P-SDA-C | 2-0-2-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with comprehensive knowledge and practical skills in image and video processing, including enhancement, restoration, compression techniques, and motion estimation, using modern engineering tools and methods.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Understand the fundamentals of digital image processing, Including image sampling, quantization, and the relationships between pixel. | 3,5 | - |
| 2. | Apply various image enhancement and restoration techniques In both spatial and frequency domains to improve image Quality. | 3,5 | - |
| 3. | Analyze different image compression methods and standards, such as huffman coding, arithmetic coding, and jpeg, to Reduce image redundancy. | 1,10 | - |
| 4. | Implement basic video processing steps and motion. Estimation techniques to enhance and compress video data Effectively. | 5,12 | |

Course Contents:

| Module – 1 | 08 Hrs. |
|---|---------|
| Fundamentals of Image Processing and Image Transforms: Digital Image fundamentals, Sampling and quantization of an Image, Relationship between pixels. Image Transforms: 2- D Discrete Fourier Transform, Properties, Discrete cosine Transform, Hadamard Transform | |
| Module – 2 | 08 Hrs. |
| Image Processing Techniques: Image Enhancement, Spatial Domain methods, Histogram Processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening Spatial filters. Frequency Domain methods : Basics of filtering in frequency domain, image smoothing, image sharpening. Image Restoration: Degradation Model, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration | |
| Module – 3 | 08 Hrs. |
| Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models: Lossy and Lossless, Huffmann coding, Arithmetic coding, run length coding, transform coding, predictive coding, JPEG standards. | |
| Module – 4 | 08 Hrs. |
| Basic Steps of Video Processing: Analog video, Digital video, Time varying image formation model, Geometric image formation, formation, sampling of video signal. | |

| | |
|--|----------------|
| Module – 5 | 07 Hrs. |
| 2D Motion Estimation: Optical flow, Pixel based motion estimation, Region based Motion estimation, Multi resolution motion estimation, Application of motion estimation in video coding. | |
| <u>Skill Development Activities Suggested</u> <p>The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.</p> | |
| <u>TEXT BOOKS:</u> <ol style="list-style-type: none"> 1. Gonzaleze and Woods ,”Digital Image Processing “, 3 rd edition , Pearson. 2. Yao wang, Joem Ostarmann and Ya – quin Zhang, “Video processing and communication”, 1st edition , PHI. | |
| <u>REFERENCE BOOKS:</u> <ol style="list-style-type: none"> 1. M. Tekalp ,”Digital video Processing”, Prentice Hall International. | |

| Course Title | Optimization Theory and Techniques | | |
|--------------|------------------------------------|-------------|---------|
| Course Code | 23SAD32 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with a thorough comprehension of optimization principles, enable them to apply these concepts to structural engineering problems, and critically evaluate a variety of optimization methods.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Formulate optimization problems specific to structural engineering applications. | 1, 2, 3 | - |
| 2. | Apply classical and modern optimization techniques to solve linear and non-linear programming problems. | 1, 5, 12 | - |
| 3. | Analyze the efficiency and feasibility of various optimization algorithms and methods. | 4, 5, 12 | - |
| 4. | Implement constrained and unconstrained optimization methods to develop solutions for structural engineering challenges. | 2, 3, 7 | |

Course Contents:

| Module – 1 | 08 Hrs. |
|---|---------|
| Introduction: Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques, algorithms-constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques, and feasibility techniques. | |
| Module – 2 | 08 Hrs. |
| Linear Programming: Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simplex methods, duality in linear programming. | |
| Module – 3 | 08 Hrs. |
| Non-linear programming: Non-linear programming, one-dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, and descent methods. | |
| Module – 4 | 08 Hrs. |

Constrained optimization techniques such as direct methods, complex methods, cutting plane methods, and exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different techniques.

Module – 5

07 Hrs.

Geometric programming: Geometric programming, conversion of NLP as a sequence of LP/ geometric programming. **Dynamic programming:** Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming.

Skill Development Activities Suggested:

The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.

TEXT BOOKS:

1. Bhavikatti S.S.- “Structural optimization using sequential linear programming”- Vikas publishing house.
2. S.S. Rao, “Optimization – Theory and Practice”- Wiley Eastern Ltd.

REFERENCE BOOKS:

1. Uri Krisch, “Optimum Structural Design”- McGraw Hill.
2. Richard Bronson, “Operation Research”- Schaum’s Outline Series.
3. Spunt, “Optimum Structural Design”- Prentice Hall.

| Course Title | Decision Support System | | |
|--------------|-------------------------|-------------|---------|
| Course Code | 23SAD323 | L-P-SDA-C | 2-0-2-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with a comprehensive understanding of various classification and regression models, the working principles of supervised and unsupervised algorithms, and the ability to identify the most suitable models to solve real-world problems.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Appraise issues related to the development of DSS | 1, 2 | - |
| 2. | Select appropriate modeling techniques | 4,10 | - |
| 3. | Analyze, design and implement a DSS | 2,5 | - |

Course Contents:

| Module – 1 | 08 Hrs. |
|--|---------|
| Introduction to decision support systems: DSS Defined, History of decision support systems, Ingredients of a DSS, Data and model management, DSS Knowledge base, User interfaces, User interfaces, The DSS user, Categories and classes of DSSs, Chapter Summary. Decisions and decision makers Decision makers: who are they, Decision styles, Decision effectiveness, How can a DSS help?, A Typology of decisions, Decision theory and simon’s model of problem solving, Bounded decision making, The process of choice, Cognitive processes, Biases and heuristics in decision making, Chapter summary. | |
| Module – 2 | 08 Hrs. |
| Decisions in the organization: Understanding the organization, Organizational culture. Modelling decision processes: Defining the problem and its structures, Decision models, Types of probability, Techniques for forecasting probabilities, Calibration and sensitivity, Chapter summary. | |
| Module – 3 | 08 Hrs. |
| Group decision support and groupware technologies: Group Decision making, the problem with groups, MDM support technologies, Managing MDM activities, the virtual workspace, chapter summary. Executive information systems: What exactly is an EIS, Some EIS history, Why area top executives so different?, EIS components, Making the EIS work, The future of executive decision making and the EIS, chapter summary. | |
| Module – 4 | 08 Hrs. |
| Designing and building decision support systems: Strategies for DSS analysis and design, The DSS developer, DSS user interface issues, chapter summary. Implementing and integrating decision support systems: DSS implementation, System evaluation, The importance of integration, chapter summary. | |

| Module – 5 | 07 Hrs. |
|--|---------|
| Creative decision making and problem solving What is creativity?, Creativity defined, The occurrence of creativity, Creative problem solving techniques, Creativity and the role of technology, chapter summary | |
| <u>Skill Development Activities Suggested:</u> The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks. | |
| <u>TEXTBOOKS:</u> 1. Decision support system. George M.Marakas. PHI, 2011 | |
| <u>REFERENCE BOOKS:</u> 1. Decision Support Systems, Marakas. 2Nd Edn, Pearson India, 2015 | |

| Course Title | Digital Marketing | | |
|--------------|-------------------|--------------|---------|
| Course Code | 23SAD324 | L-P- SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours / Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To equip students with comprehensive knowledge and practical skills in digital marketing, including online advertising, email marketing, social media marketing, and search engine optimization, to effectively engage digital consumers and enhance business strategies.

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Compare traditional and digital marketing strategies to identify unique characteristics and advantages | 2, 7 | - |
| 2. | Develop effective online advertising campaigns, including search engine ads and affiliate programs | 3, 5 | - |
| 3. | Design and manage email marketing campaigns using various tools and tracking mechanisms | 3, 5 | - |
| 4. | Implement social media marketing plans using different platforms and tools for optimal engagement | 9, 10 | - |

Course Contents:

| Module – 1 | 08 Hrs. |
|--|---------|
| Digital Marketing: Introduction to Digital Marketing. Traditional Vs. Digital Marketing, Technology behind Digital Marketing, Characteristics of Digital Marketing, Digital Marketing Strategy, Understanding Digital Consumer. | |
| Module – 2 | 08 Hrs. |
| Online Advertising: Introduction, Objective, Where to Advertise, Online AdFormat, Search Engine Ad, Network Advertising, Affiliate Programs, Landing Pages. | |
| Module – 3 | 08 Hrs. |
| Email Marketing: Introduction, Types of Email, Email Marketing Campaign Process, Email marketing Tools, Advantages and Disadvantages, Opt-in Email Advertising, Email tracking. | |
| Module – 4 | 08 Hrs. |
| Social Media Marketing (SMM): What is Social Media Marketing, Seven Myths of SMM, Characteristics of Successful Social Media Marketer, Social Media Marketing plan, Social Media marketing Tools, Publishing Blogs, Podcast and Webinars, Social Media Monitoring, Social Media: Facebook, Twitter. | |
| Module-5 | 7 Hrs |
| Search Engine Optimization (SEO): Understanding SEO, Search Engine Optimization Process – Goals, On-Page Optimization, Off-Page Optimization and Analyze, Search Engine Result Process (SERP), SEO Tools. | |

Skill Development Activities Suggested:

The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.

TEXT BOOKS:

1. . Charlesworth A. Digital marketing: A practical approach. Routledge; 2014 Jul 25.
2. Chaffey D, Ellis-Chadwick F. Digital marketing. Pearson UK; 2019 Feb 5.

REFERENCE BOOKS:

1. Kingsnorth S. Digital marketing strategy: an integrated approach to online marketing. Kogan Page Publishers; 2022 May 3.
2. Visser M, Sikkenga B, Berry M. Digital marketing fundamentals: From strategy to ROI. Taylor & Francis; 2021 Jul 5.
3. Parkin G. Digital marketing: Strategies for online success. Fox Chapel Publishing; 2016 Dec.

| | | | |
|---------------------|--|--------------------|----------------|
| Course Title | Business Intelligence and Analytics | | |
| Course Code | 23SAD325 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To provide students with a comprehensive understanding of Business Intelligence, Enterprise infrastructure, Business Methodologies, Project requirements and Data analysis and Knowledge Management and its approaches

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Explain the fundamentals of business intelligence and Link data mining with business intelligence. | 1 | - |
| 2. | Apply various modeling techniques | 1,5 | - |
| 3. | Explain the data analysis and knowledge delivery stages. | 3,5 | - |
| 4. | Apply business intelligence methods to various situations. | 1,5 | - |

Course Contents:

| | |
|--|----------------|
| Module – 1 | 08 Hrs. |
| Business Intelligence – Business Intelligence Definition, Business Intelligence decision support initiatives, Development approaches, Engineering stages and the development steps, Parallel development tracks, Business intelligence project team structure. Business case assessment: Business justification, Business drivers, Business analysis issues, Cost benefit issues, Risk assessment, Business case assessment activities, Roles involved in these activities. | |
| Module – 2 | 08 Hrs. |
| Enterprise Infrastructure Evaluation — The hardware platform, The middleware platform, DBMS Gateways, The DBMS platform, Technical Infrastructure Evaluation activities, Non Technical infrastructure evaluation, The effects of Stovepipe Development, The need for non-technical infrastructure Enterprise architecture, Enterprise Standards, Non technical Infrastructure Evaluation Activities. Project Planning: Managing the Business Intelligence project, Defining the Business Intelligence, Planning the Business Intelligence Project, Project Planning Activities. | |
| Module – 3 | 07 Hrs. |
| Project Requirements —General Business Requirements, Project specific Requirements, The Interviewing process, Project Requirements Definition activities, Data Analysis: Business Focused Data analysis, Top down Logical Data Modeling, Bottom up Source Data Analysis, Data cleansing, Data Analysis Activities. | |
| Module – 4 | 08 Hrs. |
| Business Performance Managements: BPM overview, Strategize: where do we want to go, Plan: How do we get there. Monitor, Act and adjust, Performance measurement, BPM methodologies, | |

BPM technologies and application, Performance dashboards and score cards. Collaboration, communication, group support systems and knowledge management, Making decision in group, Supporting group work with computerized system, Tools for indirect support of decision making, collaborative efforts in design, planning and project management, Creativity, idea, generation and computerized support.

Module-5

08 Hrs.

Knowledge Management: Organizational Learning and transformation, Knowledge management activities, Approaches to knowledge management, Hybrid approaches to knowledge management, Information Technology in knowledge management, Knowledge management system implementation, Roles of people in knowledge management,. Management Support Systems: Emerging trends and Impacts, RFID and new Business Intelligence application opportunities, Reality mining, Online social networking: Basics and Examples, Cloud computing and Business Intelligence, The impacts of management support system overview and impacts on organization, Issues of legality, Privacy and Ethics

TEXT BOOKS:

1. Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making, Larissa T. Moss, S. Atre, Addison Wesley.
2. Decision Support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, Dursun Delen, 9 th Edition, Pearson.

REFERENCE BOOKS:

1. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley Publications, 2009.
2. Business Intelligence: The Savvy Manager's Guide, David Loshin Morgan, Kaufman Second Edition, 2012.
3. Successful Business Intelligence: Secrets to Making BI a Killer App, Cindi Howson, McGraw- Hill, 2007.
4. The Data Warehouse Lifecycle Toolkit, Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, Wiley Publication Inc.,2007

| | | | |
|---------------------|------------------------------------|--------------------|----------------|
| Course Title | Natural Language Processing | | |
| Course Code | 23SAD331 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To Analyze , generate the natural language and to demonstrate Text mining

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|------------------------------------|----------------|-----------------|
| 1. | Analyze the natural language text. | 1,2 | - |
| 2. | Generate the natural language | 4,10 | - |
| 3. | Demonstrate Text mining | 3,5 | - |

Course Contents:

| | |
|---|----------------|
| Module - 1 | 08 Hrs. |
| Overview And Language Modelling: Overview: Origins and challenges of NLP-Language and GrammarProcessing Indian Languages- NLP Applications-Information Retrieval. Language Modelling: Various Grammarbased Language Models-Statistical Language Model. | |
| Module - 2 | 08 Hrs. |
| Word Level And Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite State Automata Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing Probabilistic Parsing. | |
| Module - 3 | 08 Hrs. |
| Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: In Fact System Overview, The GlobalSecurity.org Experience | |
| Module - 4 | 08 Hrs. |

| | |
|--|----------------|
| Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation,. Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining | |
| Module - 5 | 07 Hrs. |
| Information Retrieval And Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora. | |
| <u>Skill Development Activities Suggested:</u> <p>The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.</p> | |
| <u>TEXT BOOKS:</u> <ol style="list-style-type: none"> 1. Natural Language Processing and Information Retrieval, TanveerSiddiqui, U.S. Tiwary, Oxford University Press, 2008. 2. Natural LanguageProcessing andText Mining. Anne Kao and Stephen R. Potee, Springer-Verlag London Limited. 2007. | |
| <u>REFERENCE BOOKS:</u> <ol style="list-style-type: none"> 1. Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition. Daniel Jurafsky and James H Martin. Prentice Hall, 2008 2nd Edition. 2. Natural Language Understandin.James Allen. Benjamin/Cumming spublishing company, 2nd edition, 1995. 3. Information Storage and Retrieval systems. Gerald J. Kowalski and Mark.T. Maybury. Kluwer academic Publishers, 2000. 4. Natural Language Processing with Python.Steven Bird, Ewan Klein, Edward Loper. O'Reilly Media, 2009.. | |

| | | | |
|---------------------|---------------------------|--------------------|----------------|
| Course Title | Agile Technologies | | |
| Course Code | 23SAD332 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: To interpret the fundamental principles and practices associated with each of the agile development methods and apply the principles and practices of agile software development on a project of interest

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Define XP Lifecycle, XP Concepts, Adopting XP | 1,7 | - |
| 2. | Examine on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests | 2,5 | - |
| 3. | Demonstrate concepts to Eliminate Waste | 3,5 | - |

Course Contents:

| | |
|---|----------------|
| Module – 1 | 08 Hrs. |
| Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mento | |
| Module – 2 | 08 Hrs. |
| Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agilit. | |
| Module – 3 | 08 Hrs. |

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: “Done Done”, No Bugs, Version Control, TenMinute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, TestDriven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Module – 4

08 Hrs.

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughpu

Module – 5

07 Hrs.

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence :Software Doesn’t Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

Skill Development Activities Suggested:

The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.

TEXT BOOKS:

1. The Art of Agile Development, James shore, Chromatic, O'Reilly 2007

REFERENCE BOOKS:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin Prentice Hall 1st edition, 2002.
2. Agile and Iterative Development A Manger’s Guide, Craig Larman Pearson Education First Edition, India, 2004.

| | | | |
|---------------------|------------------------|--------------------|----------------|
| Course Title | Computer Vision | | |
| Course Code | 23SAD333 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: Explore the fundamentals of computer vision and build skills to perform shape analysis and other computer vision operations

Course Outcomes (COs): Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|--|----------------|-----------------|
| 1. | Implement fundamental image processing techniques required for computer vision | 1,3 | - |
| 2. | Implement boundary tracking techniques | 1,3 | - |
| 3. | Apply chain codes and other region descriptors and Hough Transform for line, circle, and ellipse detections. | 1,3,5 | - |
| 4. | Perform shape analysis | 1,2 | - |

Course Contents:

| | |
|--|----------------|
| Module – 1 | 08 Hrs. |
| CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color. | |
| Module – 2 | 08 Hrs. |

| | |
|--|----------------|
| Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture. | |
| Module – 3 | 08 Hrs. |
| The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering, | |
| Module – 4 | 08 Hrs. |
| Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples. | |

| | |
|---|----------------|
| Module – 5 | 07 Hrs. |
| Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry | |
| <p style="text-align: center;"><u>Skill Development Activities Suggested:</u></p> <p>The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks.</p> | |
| <p><u>TEXT BOOKS:</u></p> <ol style="list-style-type: none"> 1. Computer Vision – A Modern Approach, David A. Forsyth and Jean Ponce PHI Learning 2009 | |
| <p><u>REFERENCE BOOKS:</u></p> <ol style="list-style-type: none"> 1. Computer and Machine Vision – Theory, Algorithms and Practicalities, E. R. Davies Elsevier 4 th edition, 2013. | |

| | | | |
|---------------------|-------------------------------------|--------------------|----------------|
| Course Title | Enterprise Resource Planning | | |
| Course Code | 23SAD334 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective: Able to Understand Enterprise Resource Planning and its benefits and significance of Business Engineering, ERP and Management concerns

Course Outcomes (COs) : Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Understand concepts in Enterprise Resource Planning and its benefits and significance of Business Engineering, ERP and Management concerns. | 1, 2,3,10,12 | - |
| 2. | Understand the social and ethical responsibilities of a professional working in the discipline. | 7,10 | - |
| 3. | Understand Industrial and Financial Systems, SAP, Market Dynamics, TQM. | 1,2,3,8,10,12 | - |
| 4. | Get an overview of MFG/PRO, Marketing of ERP. | 1,2,3,11,12 | - |

Course Contents:

| | |
|-------------------|----------------|
| Module – 1 | 08 Hrs. |
|-------------------|----------------|

| | |
|---|----------------|
| Enterprise Resource Planning: An Overview, Accommodating Variety, Integrated Management Information, Seamless Integration, Supply Chain Management, Resource Management, Integrated Data Model, Scope, Technology, Benefits of ERP, Evolution, ERP revisited, ERF and its Modern Enterprise. | |
| Module – 2 | 08 Hrs. |
| Business Engineering and ERP: An overview, What is Business Engineering? Significance, Principles, BRP, ERP and IT, Business Engineering with Information Technology, ERP and Management Concerns. Business Modeling for ERP: An Overview, Building Business Model | |
| Module – 3 | 08 Hrs. |
| ERP- Implementation: An overview, Role of Consultants, Vendors and Users, Customization, Precautions, ERP-Post Implementation Options, ERP- Implementation Methodology, Guidelines for Implementation The ERP Domain-1: An Overview, MFG/PRO, IFS/Avalon- Industrial and Financial Systems . | |
| Module – 4 | 08 Hrs. |
| The ERP Domain-2: Baan IV, SAP, SAP R/3 Applications, Example of an Indian ERP Package, The arrival of ERP. ERP and the Competitive Advantage: An Overview, ERP and the Competitive strategy. Marketing of ERP–1: An overview, Marketing of ERP–2, TQM–1: Market Dynamics and Competitive Strategy, Total Quality Management. | |
| Module – 5 | 07 Hrs. |
| TQM–2, Case Studies: TQM - ISO 9000, An overview, Mercedes-Benz, Kee Hin Industries, Bull Electronics Angers Plant Manufacturers | |
| <u>Skill Development Activities Suggested:</u> The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks. | |
| <u>TEXT BOOKS:</u> 1. Vinod Kumar Garg., N. K. Venkatakrishnan, Enterprise Resource Planning - Concepts and Practice, PHI. 2003. 2. S. Sadagopan, Enterprise Resource Planning, PHI, 1999. | |
| <u>REFERENCE BOOKS:</u> 1. Ellen F. Monk, Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning India, 4th edition, , 2013 | |

| Course Title | Software Project Planning & Management | | |
|--------------|--|-------------|---------|
| Course Code | 23SAD335 | L-P-SDA-C | 3-0-0-3 |
| Exam | 03 Hours | Hours/ Week | 03 |
| SEE | 50 Marks | Total hours | 40 |

Course objective:. To develop a comprehensive understanding of roles in software project and process management, including process modeling, measurement, project planning, management, quality assurance, and their interrelationships

Course Outcomes (COs) : Students shall be able to

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Evaluate traditional and modern software management principles for transitioning to interactive processes, enhancing team effectiveness, and ensuring quality | 2, 9 | - |
| 2. | Manage software development artifacts using model-based architectures for effective project oversight | 5, 11 | - |
| 3. | Apply pragmatic planning techniques to align workflows with project organizations, ensuring successful project control and instrumentation | 10, 12 | - |

Course Contents:

| Module – 1 | 08 Hrs. |
|--|---------|
| Conventional Software Management: The waterfall Model, Conventional Software Management Performance. Evolution of Software Economics: Software Economics, Pragmatic Software Cost Estimation. Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, and Peer Inspections. | |
| Module – 2 | 08 Hrs. |
| .Conventional and Modern Software Management: Principles of Conventional Software Engineering, Principles of Modern Software Management, Transitioning to an Interactive Process. Life Cycle Phases: Engineering and Production Stages Inception, Elaboration, Construction, and Transition phases | |
| Module – 3 | 08 Hrs. |
| Artifacts of the Process: The Artifact Sets. Management Artifacts, Engineering Artifacts, Programmatic Artifacts. Model-Based Software Architectures: A Management Perspective and Technical Perspective. | |
| Module – 4 | 08 Hrs. |
| Flows of the Process: Software Process Workflows. Inter Trans Workflows. Checkpoints of the Process: Major milestones, Minor Milestones, Periodic Status Assessments. Interactive Process Planning: Work Breakdown Structures, Planning Guidelines, Cost and Schedule Estimating. Interaction Planning Process, Pragmatic Planning. | |

| Module – 5 | 07 Hrs. |
|--|---------|
| Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, and Evolution of Organizations. Process Automation: Building Blocks, the Project Environment. Project Control and Process Instrumentation: Server Care Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations Pragmatic Software. | |
| <u>Skill Development Activities Suggested:</u> The students with the help of the course faculty can take up relevant technical activities which will enhance their skills. The prepared report shall be evaluated for CIE marks. | |
| <u>TEXT BOOKS:</u> 1. Walker Rayce, “Software Project Management”, 1998, PEA. 2. Henrey, “Software Project Management”, Pearson. | |
| <u>REFERENCE BOOKS:</u> 1. Richard H.Thayer.” Software Engineering Project Management”, 1997, IEEE Computer Society. 2. Shere K.D.: “Software Engineering and Management”, 1998, PHI. 3. S.A. Kelkar, “Software Project Management: A Concise Study”, PHI. 4. Hughes Cotterell, “Software Project Management”, 2e, TMH. 88. | |

| Course Title | Project work Phase-1 | | |
|--------------|----------------------|-------------|---------|
| Course Code | 23SAD34 | L-P-SDA-C | 0-6-0-3 |
| Exam | - | Hours/ Week | -- |
| CIE | 100 Marks | Total hours | - |

Course objective: To provide students with an opportunity to support independent learning into a specific topic and develop interactive, communication, organisation, time management, and presentation skills.

Course Outcomes (COs) Students shall be able to:

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|------------------------------|-----------------|
| 1. | Design and execute a project, showcasing the application of theoretical concepts and research methodologies to address a specific problem or research question | 1, 2, 3, 4, 8, 9, 10, 11, 12 | - |
| 2. | Demonstrate enhanced presentation and communication skills through the effective conveyance of research findings and engaging with an academic audience during the seminar presentation | 5, 10, 12 | - |

Course Contents:

Project Phase-1

Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Presentation: Each student, under the guidance of a Faculty, is required to

- Present on the selected project orally and/or through powerpoint slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation procedure for Project Phase-1

The CIE marks awarded for Project shall be based on the evaluation of the Project Report, Project Presentation skill, and Question and Answer session as per the below scheme of evaluation. There shall be no SEE for Project Phase-1

SCHEME FOR EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|--------------|---|-----------------------|
| 1. | Project Proposal and Research Design | 20 |
| 2. | Literature Review and Theoretical Framework | 20 |
| 3. | Implementation and Data Analysis | 30 |
| 4. | Report Writing and Documentation | 10 |
| 5. | Seminar Presentation and Communication Skills | 20 |
| Total | | 100 |

| Course Title | Societal Project | | |
|--------------|------------------|--------------|---------|
| Course Code | 23SAD35 | L-P- SDA-C | 0-6-0-3 |
| Exam | 3 Hrs | Hours / Week | - |
| SEE | - | Total hours | - |

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|----------------|-----------------|
| 1. | Building solutions for real life societal problems. Improvement of their technical/curriculum skills. | 4,9,10,12 | - |
| 2. | Building solutions for real life societal problems. Improvement of their technical/curriculum skills. | 4,9,10,12 | - |

Some of the domains to choose for societal projects: Infrastructure, Health Care, Social security, Security for women, Transportation, Business Continuity, Remote working and Education, Digital Finance, Food Security, Rural employment, Water and land management, Pollution, Financial Independence, Agricultural, Finance, Primary Health care, Nutrition, Child Care, E-learning, Distance parenting, Mentorship Etc

Continuous Internal Evaluation:

SCHEME FOR TERM PAPER 1 EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|--------------|--|-----------------------|
| 1. | Identifying the real life problems and producing literature report | 20 |
| 2. | Data sampling and Cleaning | 10 |
| 3. | Establishing the right Objective | 10 |
| 4. | Developing the solution | 20 |
| 5. | Documentation/Report | 20 |
| 6. | Presentation | 10 |
| 7. | Question & Answers | 10 |
| Total | | 100 |

| Course Title | Internship | | |
|--------------|------------|-------------|---------|
| Course Code | 23SAD36 | L-P-SDA-C | 0-6-0-6 |
| Exam | 03 Hours | Hours/ Week | - |
| CIE | 100 Marks | Total hours | - |

Course objective: Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc

Course Outcomes (COs): students shall be able to:

| # | Course Outcomes | Mapping to POs | Mapping to PSOs |
|----|---|-------------------------|-----------------|
| 1. | Develop advanced research and analytical skills for further study, research, and professional work in the field of artificial intelligence and data science | 1, 2, 3, 4, 5, 8, 9, 12 | - |

Course Contents:

Internship/Professional practice:

Students under the guidance of internal guide and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship. Seminar: Each student is required to present on the internship orally and/or through power point slides. Answer the queries and involve in debate/discussion. Submit the report duly certified by the external guide. The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

SCHEME FOR TERM PAPER 1 EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|--------------|--|-----------------------|
| 1. | Topic selection, Organization, and Clarity | 10 |
| 2. | Literature Review and Research Methodology | 20 |
| 3. | Findings and Analysis | 30 |
| 4. | Discussion and Conclusion | 20 |
| 5. | Presentation | 20 |
| Total | | 100 |

| Course Title | PROJECT WORK PHASE -2 | | |
|--------------|-----------------------|--------------|-----------|
| Course Code | 23SAD41 | L-P- SDA-C | 0-8-0-18 |
| Exam | 3 Hrs | Hours / Week | - |
| SEE | 100 Marks | CIE | 100 Marks |

Project Work Phase - II:

Each student of the project batch shall be involved in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. Follow the Software Development life cycle Data Collection, Planning, Design the Test cases Validation and verification of attained results. Significance of parameters w.r.t scientific quantified data. Publish the project work in referred Journal/conferences(UGC/SCOPUS/WoS)

Continuous Internal Evaluation:

SCHEME FOR EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|---------|--------------------------------------|-----------------------|
| 1. | Project Report | 30 |
| 2. | Paper publication | 30 |
| 3. | Project Demonstration & Presentation | 30 |
| 4. | Question and Answer | 10 |
| Total | | 100 |

Note: Plagiarism check shall be carried out for Project report using Turn-it-in with less than 25% similarity and Drill-bit with less than 10% similarity index.

Semester End Evaluation:

SCHEME FOR EVALUATION

| Sl. No. | Particulars | Distribution of Marks |
|---------|--------------------------------------|-----------------------|
| 1. | Project Report | 30 |
| 2. | Procedure Writing | 15 |
| 3. | Project Demonstration & Presentation | 40 |
| 4. | Question and Answer | 15 |
| Total | | 100 |