**COURSE PLAN**

|  |  |
| --- | --- |
| Target | 45% (marks) |
| Level-1 | 35% (population) |
| Level-2 | 45% (population) |
| Level-3 | 55% (population) |

1. **Method of Evaluation**

|  |  |
| --- | --- |
| **UG** | **PG** |
| Quizzes/Tests, Assignments (30%) | Quizzes/Tests, Assignments, seminar (50%) |
| Mid Examination (20%) | End semester (50%) |
| End examination (50%) |  |

1. **Passing Criteria**

|  |  |  |
| --- | --- | --- |
| **Scale** | **PG** | **UG** |
| **Out of 10point scale** | SGPA – “6.00” in each semester  CGPA – “6.00”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” | SGPA – “5.0” in each semester  CGPA – “5.0”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” |

\*for PG, passing marks are 40/100 in a paper

\*for UG, passing marks are 35/100 in a paper

1. **Pedagogy** 
   * Lectures using Board
   * Presentations over Blackboard & Video Lectures
   * Discussions & Tutorials
   * Assessments (Class Test, Quiz, Assignments)
2. **References:**

|  |  |  |  |
| --- | --- | --- | --- |
| Text Books | Web resources | Journals | Reference books |
| Book provided by IBM |  |  | <https://www.deeplearningbook.org/>  <http://neuralnetworksanddeeplearning.com/> |

**GUIDELINES TO STUDY THE SUBJECT**

**Instructions to Students:**

1. Go through the 'Syllabus' in the Black Board section of the web-site (https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section.  These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. C**ell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail [niharika@ddn.upes.ac.in](mailto:niharika@ddn.upes.ac.in). Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

**RELATED OUTCOMES**

1. **The expected outcomes of the Program are:**

|  |  |
| --- | --- |
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| PO4 | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

1. **The expected outcomes of the Specific Program are: (upto3)**

|  |  |
| --- | --- |
| PSO1 | Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques, |
| PSO2 | Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms. |
| PSO3 | Ability to create & develop most efficient solutions by applying machine learning with analytical emphasis on industrial and research problems |

1. **The expected outcomes of the Course are: (minimum 3 and maximum 6)**

|  |  |
| --- | --- |
| CO 1 | To understand the basic concept of biological Neural Network, artificial Neural Network and its application. |
| CO 2 | Analyze the Neural network problems and learning process corresponding to different applications. |
| CO 3 | Understand the contemporary techniques and architecture of artificial neural network. |
| CO 4 | Comprehend the working of neural network and stochastic methods. |
| CO 5 | Analyze the different neural network to solve problems of moderate complexity. |

1. **Co-Relationship Matrix**

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PO/CO | PO  1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO  9 | PO  10 | PO  11 | PO  12 | PSO  1 | PSO  2 | PSO  3 |
| CO1 | 2 | 1 | 1 | 1 |  |  |  |  |  |  |  |  | 1 |  | 2 |
| CO2 | 2 | 1 | 1 | 1 |  |  |  |  |  |  |  |  | 1 |  | 2 |
| CO3 | 2 | 3 | 1 | 1 |  |  |  |  |  |  |  |  | 1 |  | 2 |
| CO4 | 3 | 3 | 1 | 3 |  |  |  |  |  |  |  |  | 1 |  | 2 |
| CO5 | 2 | 1 | 1 | 1 |  |  |  |  |  |  |  |  | 1 |  | 2 |
| Average | 2.2 | 1.8 | 1 | 1.4 |  | - | - | - | - | - | - | - | 1 | - | 2 |

1. **Course outcomes assessment plan:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **components**  **Course Outcomes** | **Assignment** | **Test/Quiz** | **Mid Semester** | **End Semester** | **Any other** |
| **CO 1** |  |  |  |  | **□** |
| **CO 2** |  |  |  |  | **□** |
| **CO3** |  |  |  |  | **□** |
| **CO 4** |  |  |  |  | **□** |
| **CO 5** |  |  | **□** |  | **□** |

**BROAD PLAN OF COURSE COVERAGE**

**Course Activities:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Unit** | **Description** | **Planned** | | | **Actual** | | | **Remarks** |
| **From** | **To** | **No. of Sessions** | **From** | **To** | **No. of Sessions** |
| **1** | **Neural Networks Introduction and Learning Processes** |  |  |  |  |  |  |  |
| **2** | **Single & Multilayer Layer Perceptrons** |  |  |  |  |  |  |  |
| **3** | **Deep Learning and Convolutional Neural Networks** |  |  |  |  |  |  |  |
| **4** | **Recurrent Neural Networks (RNN), LSTM, GRU** |  |  |  |  |  |  |  |
| **5** | **Generative Deep Learning, Transformer** |  |  |  |  |  |  |  |

Sessions: Total No. of Instructional periods available for the course

**SESSION PLAN**

**UNIT-I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session Plan | | | Actual Delivery | | | |
| Lecture | Topics to be Covered | CO Mapped | Lecture | Date | Topics Covered | CO covered |
| 1 | Description of a Neural Network, Human Brain, Models of a Neuron | CO1 |  |  | Yes | CO1 |
| 2 | Neural Networks Viewed as Directed Graphs, Application Scope of Neural Networks | CO1 |  |  | Yes | CO1 |
| 3 | Feedback, Network Architectures, Knowledge Representations | CO1 |  |  | Yes | CO1 |
| 4 | Artificial Intelligence and Neural Networks, Error Correction learning | CO2 |  |  | Yes | CO2 |
| 5 | Memory based learning, Hebbian Learning, Competitive learning | CO2 |  |  | Yes | CO2 |
| 6 | Boltzmann learning, supervised, unsupervised learning | CO2 |  |  | Yes | CO2 |
| 7 | Learning tasks, Memory and Adaptations, Statistical Nature of the Learning Process | CO2 |  |  | Yes | CO2 |
| 8&9 | Statistical Learning Theory, Probably Approximately Correct Model of Learning | CO2 |  |  | Yes | CO2 |

**SESSION PLAN**

**UNIT-II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session Plan | | | Actual Delivery | | | |
| Lecture | Topics to be Covered | CO Mapped | Lecture | Date | Topics Covered | CO covered |
| 10 | Adaptive Filtering Problems, Unconstrained Optimization Techniques, Linear Least-Squares Filters | CO3 |  |  | Yes | CO3 |
| 11 | Least-Mean-Square Algorithms, Learning Curves, Learning Rate Annealing Techniques, Perceptrons | CO3 |  |  | Yes | CO3 |
| 12&13 | Perceptron Convergence Theorem, Relations between the Perceptron and Bayes Classifier for a Gaussian Environment  Preliminary Concepts, Backpropagation Algorithm | CO3 |  |  | Yes | CO3 |
| 14 | XOR Problem, Heuristics for Making Backpropagation Algorithm Perform Better, Output Representation and Decision Rules  Feature Detection | CO3 |  |  | Yes | CO3 |
| 15 | Backpropagation and Differentiation, Hessian Matrix  Generalization, Approximations of Functions, Cross-Validations | CO3 |  |  | Yes | CO3 |
| 16 | Network Pruning Techniques, Virtues and Limitations of Backpropagation Learning, Accelerated Convergence of Backpropagation Learning, Supervised Learning Viewed as Optimization Problem | CO3 |  |  | Yes | CO3 |
| 17 | Test-1/ Online Quiz-1 |  |  |  |  |  |

**SESSION PLAN**

**UNIT-III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session Plan | | Actual Delivery | | | | |
| Lecture | Topics to be Covered | CO Mapped | Lecture | Date | Topics Covered | CO covered |
| 18 | Cover's Theorem on the Separability of Patterns, Interpolation Problem, | CO3 |  |  | Yes | CO3 |
| 19&  20 | Regularization Theory and Regularization Networks, Generalized Radial-Basis Function Networks, | CO3 |  |  | Yes | CO3 |
| 21 | Estimation of the Regularization Parameter, Approximation Properties of RBF Networks, | CO3 |  |  | yes | CO3 |
| 22 | Comparison of RBF Networks and Multilayer Perceptron’s, Kernel Regression and its Relation to RBF Networks, Learning Strategies in RBF Networks | CO4 |  |  | Yes | CO4 |

**SESSION PLAN**

**UNIT-IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session Plan | | | Actual Delivery | | | |
| Lecture | Topics to be Covered | CO Mapped | Lecture | Date | Topics Covered | CO covered |
| 23 | Entropy, Maximum Entropy Principle,Mutual Information | CO3 |  |  | Yes | CO3 |
| 24 | Kullback-Leibler Divergence , Mutual Information as an Optimization Function | CO3 |  |  | Yes | CO3 |
| 25 & 26 | Maximum Mutual Information Principle, Infomax and Redundancy Reduction,Spatially Coherent Features | CO3 |  |  |  | CO3 |
| 27 | Spatially Incoherent Features ,Independent Components Analysis | CO4 |  |  | Yes | CO4 |
| 28 | Maximum Likelihood Estimation Technique, Maximum Entropy Method | CO4 |  |  | Yes | CO4 |
| 29 | **Test-2** | CO4 |  |  |  | CO4 |

**SSESION PLAN**

**UNIT-V**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session Plan | | | Actual Delivery | | | |
| Lecture | Topics to be Covered | CO Mapped | Lecture | Date | Topics Covered | CO covered |
| 30 | Statistical Mechanics, Markov Chains, Metropolis Algorithm, Simulated Annealing | CO4 |  |  | Yes | CO4 |
| 31 | Gibbs Sampling, Boltzmann Machines, Sigmoid Belief Networks | CO4 |  |  | Yes | CO4 |
| 32 | Deterministic Boltzmann Machine, Deterministic Sigmoid Belief Networks, Deterministic Annealing | CO5 |  |  | Yes | CO5 |
| 33 | Deterministic Boltzmann Machine, Deterministic Sigmoid Belief Networks, Deterministic Annealing | CO5 |  |  | Yes | CO5 |
| 34 | Computational Power of Neural Networks, Learning Algorithms Backpropagation through Time | CO5 |  |  | Yes | CO5 |
| 35 | Real-Time Recurrent Learning ,Vanishing Gradients in Recurrent Networks | CO5 |  |  | Yes | CO5 |
| 36 | **Quiz-2** |  |  |  |  |  |

**PERIODIC MONITORING**

**Actual date of completion and remarks, if any**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Components** | | **From** | **To** | **From** | **To** | **From** | **To** |
| **Duration (Mention from and to dates)** | | **4 Aug 22** | **22 Dec 22** |  |  |  |  |
| **Percentage of Syllabus covered** | | **100%** |  |  |  |  |  |
| **Lectures** | **Planned** | **36** |  |  |  |  |  |
| **Taken** | **36** |  |  |  |  |  |
| **Tutorials** | **Planned** | **---** | **--** |  |  |  |  |
| **Taken** | **---** | **--** |  |  |  |  |
| **Test/quizzes** | **Planned** | **2** |  |  |  |  |  |
| **Taken** | **2** |  |  |  |  |  |
| **CO's Addressed** | **5** |  |  |  |  |  |
| **CO's Achieved** | **5** |  |  |  |  |  |
| **Assignments** | **Planned** | **2** |  |  |  |  |  |
| **Taken** | **2** |  |  |  |  |  |
| **COs Addressed** | **5** |  |  |  |  |  |
| **COs** | **5** |  |  |  |  |  |
| **Signature of Faculty** | |  | |  | |  | |
| **Head of the Department** | |  | |  | |  | |
| **A.M.R.C** | |  | |  | |  | |

**Signature of HOD/ Dean Signature of Faculty**

**Date Date**

**INDIRECT ASSESSMENT**

**Sample format for Indirect Assessment of Course outcomes:**

|  |
| --- |
| NAME: |
| ENROLLMENT NO: |
| SAP ID: |
| COURSE: |
| PROGRAM: B.Tech (CSE + AI&ML) |

Please rate the following aspects of course outcomes of --------------------.

Use the scale 1-3\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| course Outcomes | Statement | 1 | 2 | 3 |
| CO1 | Achieved (strong) |  |  |  |
| CO2 | Strong |  |  |  |
| CO3 | Moderate |  |  |  |
| CO4 | Strong |  |  |  |
| CO5 | Moderate |  |  |  |

MODERATE

3

STRONG

2

WEAK

1

**\***

**INDIRECT ASSESSMENT**

**Sample format for Indirect Assessment of Course outcomes:**

|  |
| --- |
| NAME: |
| ENROLLMENT NO: |
| SAP ID: |
| COURSE: |
| PROGRAM: |

Please rate the following aspects of course outcomes of --------------------.

Use the scale 1-3\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| course Outcomes | Statement | 1 | 2 | 3 |
| CO1 | Achieved (strong) |  |  | yes |
| CO2 | Strong |  |  | yes |
| CO3 | Moderate |  |  | yes |
| CO4 | Stronge |  |  | yes |
| CO5 | Moderate |  | yes |  |

MODERATE

3

STRONG

2

WEAK

1

**\***

**INSTRUCTIONS FOR FACULTY**

**Instructions for faculty**

* Faculty should keep track of the students with low attendance and counsel them regularly.
* Course coordinator will arrange to communicate the short attendance (as per UPES policy) cases to the students and their parents monthly.
* Topics covered in each class should be recorded in the table of RECORD OF CLASS TEACHING (Suggested Format).
* Internal assessment marks should be communicated to the students twice in a semester.
* The file will be audited by respective Academic Monitoring and Review Committee (AMRC) members for theory as well as for lab as per AMRC schedule.
* The faculty is required to maintain these files for a period of at least three years.
* This register should be handed over to the head of department, whenever the faculty member goes on long leave or leaves the Colleges/University.
* For labs, continuous evaluation format (break-up given in the guidelines for result preparation in the same file) should be followed.
* Department should monitor the actual execution of the components of continuous lab evaluation regularly.
* Instructor should maintain record of experiments conducted by the students in the lab weekly.
* Instructor should promote students for self-study and to make concept diary, due weightage in the internal should be given under faculty assessment for the same.
* Course outcome assessment: To assess the fulfilment of course outcomes two different approaches have been decided. Degree of fulfillment of course outcomes will be assessed in different ways through direct assessment and indirect assessment. In Direct Assessment, it is measured through quizzes, tests, assignment, Mid-term and/or End-term examinations. It is suggested that each examination is designed in such a way that it can address one or two outcomes (depending upon the course completion). Indirect assessment is done through the student survey which needs to be designed by the faculty (sample format is given below) and it shall be conducted towards the end of course completion. The evaluation of the achievement of the Course Outcomes shall be done by analyzing the inputs received through Direct and Indirect Assessments and then corrective actions suggested for further improvement.

**Planning for Remedial Classes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
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|  |  |  |  |  |
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|  |  |  |  |  |

**Signature of HOD/ Dean Signature of Faculty Date Date**