# CE 491: DEEP LEARNING APPLICATIONS AND AI
## B.TECH 7TH SEMESTER (CIVIL)
PROGRAMME ELECTIVE - IV

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Credits and Hours:

| Teaching Scheme | Theory | Tutorial/Practical | Total | Credit |
|---|---|---|---|---|
| Hours/week | 4 | 2 | 6 | 5 |
| Marks | 100 | 50 | 150 | |

### A. Objective of the Course:

The main objectives of the course are:

- To make students aware about Deep Learning and Artificial Intelligence applications
- To learn about the most effective AI techniques, and gain practice implementing them
- To learn how to quickly and powerfully apply these techniques to new problems
- To make students aware about field where AI can be applied in civil engineering problems

### B. Outline of the Course:

| Sr. No. | Title of the Unit | Minimum Number of Hours |
|---|---|---|
| 1 | Introduction | 10 |
| 2 | Deep neural network | 12 |
| 3 | Improving deep neural network | 10 |
| 4 | Convolution Neural Network | 10 |
| 5 | Sequence models | 10 |
| 6 | Structuring Deep learning project | 08 |

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. **Detailed Syllabus:**

| | | | |
|---|---|---|---|
| **1** | **Introduction** | **10 Hours** | 16% |
| 1.1 | Introduction: deep learning | | |
| **1.2** | Tools for deep learning | | |
| **1.3** | Shallow and deep neural network | | |
| 1.4 | Tensor flow | | |
| **2** | **Deep Neural Network** | **12 Hours** | 20% |
| 2.1 | Forward propagation | | |
| 2.2 | Backpropagation | | |
| 2.3 | Application: Load Forecasting | | |
| **3** | **Improving Deep Neural Network** | **10 Hours** | 17% |
| 3.1 | Learning rate, Activation Function | | |
| 3.2 | Number of Layers and Neurons | | |
| 3.3 | Overfitting and Underfitting Test | | |
| 4 | **Convolution Neural Network** | **10 Hours** | 17% |
| 4.1 | Convolution operation | | |
| 4.2 | Padding and strides | | |
| 4.3 | Activation functions | | |
| 4.4 | Pooling and dropout layers | | |
| 5 | **Sequence models** | **10 Hours** | 17% |
| 5.1 | Time series and sequence data | | |
| 5.2 | Modelling data for sequence learning | | |
| 5.3 | Recurrent neural network | | |
| 5.4 | Long short-term memory network | | |
| **6** | **Structuring Deep learning project** | **08 Hours** | 13% |

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures and practical session which carries 10 Marks and 5 marks weightage respectively.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignment/Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a practical session where students have an opportunity to build an appreciation for the concepts being taught in lectures.

**E.** Students Course Outcomes:

On successfully completion of the course, students will be able to

- understand fundamental of Deep Learning and Artificial Intelligence,
- To select any R&D field related to application of AI,
- To solve difficult and complex problem of computer science using AI techniques.
- Identify fields where AI can be applied

**F. Recommended Study Material:**

**Reference Books:**


1. Stuart Russell, Artificial Intelligence – A Modern Approach (3 Edition), Pearson, U.K., 2016.
2. Tariq Rashid, Make your own neural network, CreateSpace Independent Publishing Platform, U.S., 2016.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, The MIT Press, Cambridge, England, 2017.
4. Seth Weidman, Deep Learning from scratch, O'Reilly media, U.S.A., 2019.


**Web Materials:**

1. https://www.udemy.com/course/artificial-intelligence-for-civil-engineers-part-1/
2. https://www.udemy.com/course/artificial-intelligence-for-civil-engineers-part-2/

## LIST OF PRACTICALS

| Practical No. | Name of Practical |
|---|---|
| 1 | Application of hybrid artificial intelligence approaches for hydraulic problems |
| 2 | Using artificial neural networks for estimation of the energy consumption obtained by dams and hydropower plants |
| 3 | Swarm intelligence for optimum weight of the structures |
| 4 | Metaheuristic optimization algorithm in design optimization of 2D and 3D steel or concrete structure |
| 5 | Application of fuzzy logic in civil engineering problems |
| 6 | Optimization model for single- and multi-objective solutions for construction management |