INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING)**
SEMESTER	**7**
COURSE TITLE	**DEEP LEARNING**
COURSE CODE	**01CE0729**
COURSE CREDITS	**3**

Objective:

1 To understand fundamentals and advanced concepts of deep learning and build, train, and optimize neural networks for real-world applications, explore modern architectures such as CNNs, RNNs, Transformers, and Generative AI.

Course Outcomes: After completion of this course, student will be able to:

1 Understand core concepts of deep learning and neural networks.

2 • Design and implement deep learning models for structured and unstructured data.

3 • Apply CNN, RNN, and Transformer architectures to real-world problems.

4 Evaluate and optimize deep learning models.

5 • Develop AI solutions using modern frameworks.

Pre-requisite of course: Linear Algebra, Probability & Statistics, Python Programming, Basic Machine Learning.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
2	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Deep Learning** AI vs ML vs DL, Neural Networks basics, Perceptron, Activation functions, Loss functions, Gradient Descent, Backpropagation, Overfitting & Regularizatio	5
2	**Deep Neural Networks & Optimization** Multi-layer Perceptron (MLP), Initialization techniques, Optimization algorithms (SGD, Adam, RMSProp), Hyperparameter tuning, Batch Normalization, Dropout	6
3	**Convolutional Neural Networks (CNNs)** Image processing basics, CNN architecture, Convolution, Pooling, Popular models (LeNet, AlexNet, VGG, ResNet), Transfer Learning	6

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Contents : Unit	Topics	Contact Hours
4	**Sequence Models & Transformers** RNN, LSTM, GRU, Sequence modeling, Attention mechanism, Transformer architecture, BERT, GPT basics, NLP applications	6
5	**Generative AI & Advanced Topics** Autoencoders, GANs, Diffusion Models, Large Language Models (LLMs), Ethics in AI, Explainable AI (XAI)	5
Total Hours		**28**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Practical 1** Implementation of Perceptron using Python	2
2	**Practical 2** Training MLP using TensorFlow/PyTorch	2
3	**Practical 3** Optimization techniques comparison	2
4	**Practical 4** Image classification using CNN	2
5	**Practical 5** Transfer Learning using pre-trained models	2
6	**Practical 6** Sequence prediction using RNN/LSTM	2
7	**Practical 7** NLP task using Transformers	2
8	**Practical 8** Autoencoder for dimensionality reduction	2
9	**Practical 9** GAN implementation for image generation	2
10	**Practical 10** Model deployment using Flask/Streamlit	2
11	**Practical 11** Explainability using SHAP/LIME	2
12	**Practical 12** Hyperparameter tuning using Grid/Random Search	2
Total Hours		**24**

Textbook :

1 Deep Learning, Ian Goodfellow, The MIT Press, 2015

References:

1 Hands-On Machine Learning with Scikit-Learn & TensorFlow, Hands-On Machine Learning with Scikit-Learn & TensorFlow, Aurélien Géron , O'Reilly Media, 2017

References:

2 Deep Learning with Python , Deep Learning with Python , François Chollet , Manning Publications, 2017

3 CS224n (Online Resources) , CS224n (Online Resources) , Stanford CS231n , -, -

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	10.00	30.00	30.00	30.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1 https://onlinecourses.nptel.ac.in/noc20_cs62/preview

2 https://onlinecourses.nptel.ac.in/noc26_cs66/preview

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