Proposal for New Course		
Course Number	**:**	MB530
Course Name	**:**	Neural Networks Fundamentals for Business
Credits	**:**	2-0-0-2 (L-T-P-C)[1]
Prerequisites	**:**	None
Intended for	**:**	MBA
Distribution	**:**	Compulsory
Semester	**:**	Even

Preamble

Neural networks gained prominence in the business slowly starting in 2010 with the advancements in processing and storage technologies. Neural networks is playing a crucial role in machine learning system development to implement AI based systems. Recent use of neural networks in enterprises is growing in a rapid rate. Business domains that have witnessed neural network use include banking and finance, sales and marketing, transportation, healthcare etc. This course provides a soft introduction to basics of neural network and its potential business applications.

Objective

On completion of this course, the student should be able to:

- Understand the basics of neural networks and its architecture
- Identify the context for neural networks
- analyse performance of neural network
- learn how to use a neural network in a given situation
- Identify its impact on specific industry and company

[1] L= Lectures per week, T=Tutorials per week – P = Practical/Lab session per week – C = Credits for course

Course Modules with Quantitative lecture hours		
Module 1	**Introduction to Neural Networks**	**(2)**
History of Neural Networks, Real and artificial Neurons, Maths behind neural network, Types of Neural Networks.		
Module 2	**Perceptron**	**(4)**
Neuron as a basic processing element, single and Multiple Perceptrons, Linear and nonlinear regression models of neural network, Activation function and its necessity, smooth and non-smooth activation functions- Sigmoid, Tanh, ReLU, argmax and softmax, feed-forward networks, deep networks and connectionism-distributed representation.		
Module 3	**Backpropagation and Gradient Descent**	**(8)**
Neural Networks training processes, Constants and variables in a network, weight initialization-Random, Glorot initialization, cost functions, Cross-entropy functions, Rosenblatt's perceptron training, gradient descent method, Gradient Descent for solving a simple Learning problem, Perceptrons for identifying patterns, Gradient Descent for Multilevel Neural Networks, Backpropagation Method – Forward and Backward Pass, Adjusting the Weights, Learning Rate-static and dynamic, Stochastic gradient descent-batch and mini-batch gradient descent, Neural network architecture – Selecting number of layers and number of neurons per layer.		
Module 4	**Supervised Learning**	**(6)**
Fully connected neural networks, Exploring the dataset, identifying biases in the dataset, Data drift and Splitting the dataset to training, testing and validation datasets, Bias-variance tradeoff through neural network architecture, bias and variance reduction techniques, diagnosing bias and variance, Neural network model building, parameter tuning, Dealing with data leakage, interpretation of learning curves, Learning customer churn through backpropagation. Neural networks for multiclass classification, Loss function for multiclass classification (eg. MNIST/iris dataset). Quantitative and qualitative evaluation of the solution. Vanishing gradient, Selecting right activation function, Neural Network Regression on practical datasets (eg. Boston dataset or churn dataset) and cases.		

Module 5	**Unsupervised Learning**	**(4)**
Competitive Learning, Kohnen Self-organising maps (SOM), SOM Dimensionality and size of the map, Data preprocessing for SOM, deciding on Number of clusters, Performance assessment, SOM clustering of appropriate datasets and cases.		
Module 6	**Time Series Forecasting**	**(4)**
Fundamentals of time series forecasting, types of time series forecasting, Time series smoothing and decomposition, ARIMA models, Neural network autoregressive models. [10]		

Lab Exercises (If applicable):
Using specific software package like RapidMiner/SPSS/Weka/Azure etc

Textbooks:	
1.	
2.	
Reference Book:	
1	Kotu V. and Deshpande, B., Data Science: Concepts and Practice, Morgan Kauffman Publications, 2019.
2	J. Kelleher, B.M. Namee and A. D'Arcy. Fundamentals of Machine Learning for Predictive Data Analytics, MIT Press, 2020.
3	J.D. Kelleher, Deep Learning, MIT Press, 2019.
4	James M. Keller, Derong Liu, and David B. Fogel, Fundamentals of Computational Intelligence Neural Networks, Fuzzy Systems, and Evolutionary Computation, Wiley-IEEE Press, 2016.
5	Phil Kim - MatLab Deep Learning with Machine Learning, Neural Networks and Artificial Intelligence, Apress, 2017.
6	Scot Page, The Model Thinker, Basic Books, 2018.

7	Wei Di, Anurag Bhardwaj and Jianing Wei, Deep Learning Essentials: Your hands-on guide to the fundamentals of deep learning and neural network modelling, Packt Publications, 2018
8	Bernhard Mehlig - Machine Learning with Neural Networks: An Introduction for Scientists and Engineers, Cambridge University Press, 2021.