National Institute of Technology, Tiruchirappalli, Tamil Nadu - 620015

Department of Computer Applications

COURSE PLAN – PART I			
Name of the programme and specialization	M. Tech. Data Analytics		
Course Title	Deep Learning and its Applications		
Course Code	CA612	No. of Credits	3
Course Code of Pre-requisite subject(s)	-	-	-
Session	Jan, 2023	Section (if, applicable)	-
Name of Faculty	Dr. P.J.A. Alphonse	Department:	Computer Applications
Official Email	alphonse@nitt.edu	Telephone No.	0431 250 3742
Name of PAC Chairman	Dr. B.Balaji		
Official E-mail	balaji@nitt.edu	Telephone No.	8971027077
Course Type (please tick appropriately)	✓ Core course	☐ Elective course	

Syllabus (approved in BoS)

INTRODUCTION – Learning – Various types Learning – Machine Learning: issues and challenges – CPU vs GPU – massive parallelism – Introduction to Deep Learning – Deep Learning Models: CNN – RNN – AE – GAN – real world applications of Deep Learning – Packages used for Deep Learning.

DEEP LEARNING – Introduction – shallow neural networks – Deep neural networks – Architecture Design – Convolutional Neural Networks – Introduction – Convolution (1D and 2D) – Pooling – Training of network – Hyper parameter tuning – pre-trained models: AlexNet – GoogleNet – Resnet – VGG-16 – VGG-19 – ImageNet – Case study of CNN (Healthcare – Agriculture – Stock Market – Weather Forecasting.

SEQUENCE MODELING – Recurrent Neural Network (RNN) Model – Types of RNNs – Vanishing Gradients with RNN – Gated Recurrent Unit – Long Short Term Memory (LSTM) – Deep Recurrent Neural Networks – RNN for Time Series – Transformer Network Models - Case Studies on Recent Real World Problems.

AUTOENCODERS AND GENERATIVE ADVERSARIAL NETWORKS - Autoencoders – Architecture of Autoencoders – Types of Autoencoders – Applications of Autoencoders – Generative Models – Generative Adversarial Networks – Applications – Autoencoders vs Generative Adversarial Networks – Use Cases.

DEEP REINFORCEMENT LEARNING- Foundations of Reinforcement Learning – Value-based models – Policy-based models – Multi-Agent Reinforcement Learning – Deep Q-Learning – SARSA Learning – Real World Applications.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press 2016.
2. Andrew Glassner, Deep Learning from basics to practice. Volume 1 & 2, Kindle Edition, 2018.
3. François Chollet, Deep Learning with Python, Manning Publications, 2018.

COURSE OBJECTIVES

To introduce the techniques of deep learning

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO)
1.Explore the essentials of Machine Learning, Deep Learning and Deep Network architectures	1,2,3
2. Define, train and use Deep Neural Networks for solving real world problems that require artificial intelligence based solutions	1,2,3,5
3. Apply deep learning algorithms to solve problems that require Machine Learning based solutions	4,5,11,12
4. Deduce complex tasks by various Mathematical logic and apply Deep Learning and Deep Network architectures to solve it.	4,5,11,12

COURSE PLAN – PART II

COURSE OVERVIEW

This Course introduces the concepts of Various types of Learning, Machine Learning issues and challenges,CPU vs GPU massive parallelism and the building blocks used in these Deep Learning based solutions. Specifically, we will learn about feedforward neural networks, convolutional neural networks, recurrent neural networks. We will also look into Sequence Modeling like Recurrent Neural Network (RNN) Model, Vanishing Gradients with RNN – Gated Recurrent Unit – Long Short Term Memory (LSTM) and Deep Recurrent Neural Networks. Architecuture , types and Applications of Autoencoders vs Generative Adversarial Networks. Finally we will look into Foundations of Reinforcement Learning with Value-based models and Policy-based models,Multi-Agent Reinforcement Learning ,Deep Q-Learning, SARSA Learning and Real World Applications.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	Week 1/ 3hrs	Course introduction, Various types of Learning.	Online Whiteboard and Power Point Presentation
2.		Machine Learning including issues and challenges.	Online Whiteboard and Power Point Presentation

3.		CPU vs GPU massive parallelism	Online Whiteboard and Power Point Presentation
4.	Week 2/ 3hrs	Introduction to Deep Learning	Online Whiteboard and Power Point Presentation
5.		Deep Learning Models: Convolutional Neural Networks	Online Whiteboard and Power Point Presentation
6.		RNN	Online Whiteboard and Power Point Presentation
7.	Week 3/ 4hrs	AE and GAN	Online Whiteboard and Power Point Presentation
8.		Real world applications of Deep Learning	Online Whiteboard and Power Point Presentation
9.		Packages used for Deep Learning	Online Whiteboard and Power Point Presentation
10.		Architecture Design of Convolutional Neural Networks	Online Whiteboard and Power Point Presentation
11.	Week 4/ 4hrs	Training of network	Online Whiteboard and Power Point Presentation
12.		Hyper parameter tuning	Online Whiteboard and Power Point Presentation
13.		Pre-trained models: AlexNet	Online Whiteboard and Power Point Presentation
14.		GoogleNet – Resnet	Online Whiteboard and Power Point Presentation
15.	Week 5/ 3hrs	VGG-19 – ImageNet	Online Whiteboard and Power Point Presentation
16.		Case study of CNN (Healthcare – Agriculture)	Online Tutorial & Whiteboard and Power Point Presentation
17.		Stock Market and Weather Forecasting.	Online Whiteboard and Power Point Presentation
18.	Week 6/ 3hrs	– Recurrent Neural Network (RNN) Model	Online Whiteboard and Power Point Presentation
19.		Types of RNNs	Online Tutorial & Whiteboard and Power Point Presentation

20.		Vanishing Gradients with RNN	Online Whiteboard and Power Point Presentation
21.	Week 7/ 4hrs	– Gated Recurrent Unit	Online Tutorial & Whiteboard and Power Point Presentation
22.		Long Short Term Memory (LSTM)	Online Tutorial & Whiteboard and Power Point Presentation
23.		Deep Recurrent Neural Networks	Online Whiteboard and Power Point Presentation
24.		RNN for Time Series	Online Tutorial & Whiteboard and Power Point Presentation
25.	Week 8/ 3hrs	Transformer Network Models	Online Whiteboard and Power Point Presentation
26.		Case Studies on Recent Real World Problems	Online Whiteboard and Power Point Presentation
27.		Architecture of Autoencoders.	Online Whiteboard and Power Point Presentation
28.	Week 9/ 4hrs	Types of Autoencoders	Online Tutorial & Whiteboard and Power Point Presentation
29.		Applications of Autoencoders	Online Whiteboard and Power Point Presentation
30.		More Applications of Autoencoders	Online Whiteboard and Power Point Presentation
31.		Autoencoders vs Generative Adversarial Networks	Online Whiteboard and Power Point Presentation
32.	Week 10/ 3hrs	Applications of Autoencoders	Online Tutorial & Whiteboard and Power Point Presentation
33.		Applications of Generative Adversarial Networks	Online Whiteboard and Power Point Presentation
34.		Use Cases.	Online Tutorial & Whiteboard and Power Point Presentation
35.	Week 11/ 3hrs	Foundations of Reinforcement Learning.	Online Whiteboard and Power Point Presentation
36.		Value-based models and Policy-based models.	Online Whiteboard and Power Point Presentation

37.		Multi-Agent Reinforcement Learning	Online Whiteboard and Power Point Presentation
38.	Week 12/ 3hrs	Deep Q-Learning	Online Whiteboard and Power Point Presentation
39.		SARSA Learning	Online Whiteboard and Power Point Presentation
40.		Real World Applications.	Online Whiteboard and Power Point Presentation

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assesment 1	As per schedule	60 Minutes	10
2	Assesment 2	8th week	60 Minutes	10
3	Assignment and Case study	9th week	20 Minutes	15
3	Assignment and Case study	12th week	20 Minutes	15
4	Final Assessment *	As per schedule	120 Minutes	50

MODE OF CORRESPONDENCE (email/ phone etc.,)
Students can interact with the faculty member at **alphonse@nitt.edu** or thru' intercom number **3742**

COMPENSATION ASSESSMENT POLICY
Compensation assessment policy is to conduct only on medical grounds or on-duty activities on producing certificate from competent authority. Weightage is 30%.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- The students through the class representative may give their feedback at any time to the course chairman which will be duly addressed.
- The students may also give their feedback during class committee meeting.
- Course Outcome Survey' form will be distributed on the last working day to all the students and the feedback on various rubrics will be analysed.

- The COs will be computed after arriving at the final marks.

COURSE POLICY (including compensation assessment to be specified)

Students who are all absent for both the cycle test for a genuine reason may be given CPA and it will cover the portion of cycle test 1 and 2.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

The students can get their doubts clarified at any time with their faculty member with prior appointment

FOR APPROVAL

Course Faculty **CC- Chairperson** **HOD**

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