

## Semester IV

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-IV</b>
<b>Subject Code: PG4.1</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>DEEP LEARNING</b>

**Course Objectives:**

- Understanding Human learning aspects.
- Understanding primitives in learning process by computer.
- Understanding nature of problems solved with Deep Learning

Unit	Topics Details	No. of Lectures
I	<p><b>Perceptron:</b> What is a Perceptron? Implementing perceptron, Introducing &amp; Implementing Weights &amp; Bias, Multilayer Perceptron, Limitations of perceptron.</p> <p><b>Introduction to Deep Learning:</b>                      What is deep learning? Biological and artificial neurons, ANN and its layers, Input layer, Hidden layer, Output layer, exploring activation functions, the sigmoid function, the tanh function, The Rectified Linear Unit function, The leaky ReLU function, The Swish function, The softmax function, Forward propagation in ANN, How does ANN learn?</p>	15
II	<p><b>Getting to Know Tensor Flow</b>                      What is Tensor Flow? Understanding computational graphs and sessions, Sessions, Variables, constants, and placeholders, Introducing Tensor Board, Creating a name scope.</p> <p>Back propagation Algorithm, Neural Network Training,</p> <p><b>Convolutional Neural Networks:</b>                      Overall Architecture, The Convolution Layer, Issues with the Fully Connected Layer, Convolution Operations, Padding, Stride, Batch Processing, The Pooling Layer, Implementing a Convolution Layer, Implementing a Pooling Layer, Implementing a CNN, Visualizing a CNN.</p>	15
III	<p><b>Optimizers in DL:</b> Gradient Descent, Stochastic Gradient Descent, Mini-Batch Gradient Descent, SGD with Momentum, AdaGrad (Adaptive Gradient Descent), RMS-Prop (Root Mean Square Propagation), AdaDelta, Adam (Adaptive Moment Estimation).</p> <p><b>Introducing RNNs:</b>                      RNN implementation and training, Backpropagation through time, Vanishing &amp; exploding gradients, long short-term memory LSTM, Different types of RNN architectures:                      -One-to-one architecture                      -One-to-many architecture</p>	15

	-Many-to-one architecture -Many-to-many architecture.	
IV	<b>Deep Unsupervised Learning:</b> Auto encoders (standard, sparse, denoising, contractive, etc), Variational Auto encoders, <b>Deep Generative Models GANS.</b>	15
	<b>Total</b>	<b>60</b>

**Reference Books:**

1. (Adaptive Computation and Machine Learning series) - Deep Learning- (2016), Ian Goodfellow, Yoshua Bengio, Aaron Courville The MIT Press2016
2. Deep Learning with Python, François Chollet Manning,2018
3. Fundamentals of Deep Learning\_ Designing Next-Generation Machine Intelligence Algorithms, Nikhil Buduma, Nicholas Locascio, O’Reilly Media, 2017

<b>Branch: M.Sc.(C.S.)</b>	<b>SEMESTER-IV</b>
<b>Subject Code: PG4.2</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>Natural Language Processing</b>

**COURSE OBJECTIVES:**

1. To learn the basics of Natural Language Processing and its applications.
2. To learn linguistics essentials and building blocks of Natural Language Processing.
3. To learn the techniques in natural language processing.
4. Be familiar with natural language understanding and generation.
5. To understand the information retrieval techniques.

**COURSE OUTCOMES:**

After completion of course, students would be able to:

1. Understand different building blocks of NLP.
2. Design algorithms for NLP problems.
3. Understand machine translation and its techniques.
4. Learn and use different tools for NLP.

Modules	Sr. No.	Topic and Details	No. of Lectures Assigned	Marks Weight age %
UNIT-I	1	<b>Introduction:</b> Need for processing of natural languages, Language processing levels, Issues and challenges in NLP, History, Classical approaches to NLP with knowledge bases and linguistic rules. Introduction to formal languages, finite state automata and regular expressions.	9	15

		Applications of NLP.		
UNIT-II	2	<b>Morphology and Phonology:</b> Morphology fundamentals, Inflectional and Derivational morphology, Morphological parsing, Finite State transducers, N- gram language models, phonetics fundamentals, phoneme and phonological rules, machine learning of phonology, phonological aspects of prosody and speech synthesis.	9	15
UNIT-III	3	<b>Part-of-Speech Tagging and Parsing:</b> Word Classes, Part of speech tagging, Tagsets, Rule based, Stochastic and Transformation based POS tagging. Basic parsing strategies, top down parsing, bottom up parsing, parsing with context free grammars, a basic top down parser, Earley parser, CYK parser, Finite state parsing methods, Unification of feature structures.	9	15
UNIT-IV	4	<b>Semantic Analysis and Pragmatics:</b> Lexical Semantics, Lexemes, Relations among lexemes and their senses, WordNet, Internal structure of words, metaphor and metonymy & their computational approaches, Word Sense Disambiguation.	9	15
UNIT-V	5	Discourse, Reference resolution, syntactic and semantic constraints on coreference, pronoun resolution reference, text coherence, discourse structure, Dialogue-Acts, structure, conversational agents, Introduction to language generation, architecture, discourse planning.	9	15

**Text Book:**

1. D. Jurafsky and J. H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education.
2. J. Allen, “Natural Language Understanding”, Addison Wesley.
3. T. Siddiqui and U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press.

**Reference Books:**

1. J. Handke, “The Structure of the Lexicon: Human Versus Machine (Natural Language Processing)”, Mouton de Gruyter.
2. Bharati, V. Chaitanya and R. Sangal, “Natural Language Processing: A Paninian Perspective”, Prentice Hall of India.

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-III</b>
<b>Subject Code: PG4.3</b>	<b>Practical:02 Credit:02</b>
<b>Subject Title</b>	<b>MOBILE APPLICATIOND EVELOPMENT USING ANDROID PROGRAMMING</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No. of Lectures Assigned</b>	<b>Marks Weightage</b>
UNITI	1	What is Android, Android versions and its feature set The various Android devices on the market, The Android Market application store, Android Development Environment-System Requirements, Creating Android Virtual Devices (AVDs)	5	10
UNITII	2	Android Software Development Platform, The Directory Structure of an Android Project , Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes , Launching Your Application: The Android Manifest.xml File , Creating Your First Android Application	5	20
UNITIII	3	Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components Android Manifest XML: Declaring Your Components, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool	10	15
	4	Displaying Text with Text View, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users, Adjusting Progress with Seek Bar, Working with Menus using views, Gallery, Image Switcher, GridView, and ImageView views to display images, Creating Animation	10	20

UNITIV	5	Intent Overview, Implicit Intents, Creating the Implicit Intent Example Project, Explicit Intents, Creating the Explicit Intent Example Application, Intents with Activities, Intents with Broadcast Receivers, An Overview of Threads, The Application Main Thread, Thread Handlers, A Basic Threading Example, Creating a New Thread, Implementing a Thread Handler, Passing a Message to the Handler.	10	20
	6	Sending SMS Messages Programmatically, Getting Feedback after Sending the Message Sending SMS Messages Using Intent Receiving, sending email, Introduction to location-based service, configuring the Android Emulator for Location-Based Services, Map-Based Activities Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures	10	15

### Reference Books

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd RanchLLC,*3rdedition*,2017.
2. Christian Keur and Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, *6th edition*,2015.
3. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java8 in Action: Lambdas, Streams, and Functional-Style Programming, Manning Publications,2015.
4. Benjamin J. Evans and Martijn Verburg, The Well-Grounded Java Developer: Vital Techniques of Java 7andPolyglotProgramming,ManningPublications,2013.
5. Brian Fling, Mobile Design and Development, O’ReillyMedia,2009
6. Maximiliano Firtman, Programming the Mobile Web,2nded.,O’ReillyMedia,2013.
7. Christian Crumlish and Erin Malone, Designing Social Interfaces, O’Reilly Media, 2015.
8. Benjamin Muschko, Gradle inAction,ManningPublications,2014.
9. Craig Larman, Applying UML and Patterns: A Guide to Object-Oriented Analysis and Design and Iterative Development,3rded., PrenticeHall,2004.

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-IV</b>
<b>Subject Code: PG4.4</b>	<b>Practical: 02</b> <b>Credit: 02</b>
<b>Subject Title</b>	<b>Natural Language Processing LAB</b>

### **COURSE OBJECTIVES:**

1. To understand and implement the basics of Natural Language Processing.
2. Learn and use different tools for NLP like NLTK.
3. To implement NLP task like Names Entity Recognition, Syntactic and Semantic analysis and Word Sense disambiguation.

### **COURSE OUTCOMES:**

After completion of course, students would be able to:

1. Understand different building blocks of NLP.
2. Design algorithms for NLP problems.
3. Understand machine translation and its techniques.
4. Learn and use different tools for NLP.

### **SAMPLE EXERCISES:**

#### Experiment 1: Part-of-Speech Tagging

Choose 2 sentences from each of the 3 sets below (6 total) and assign part-of-speech (POS) tags to each token of each sentence.

Sentences

(1)

- a. The old car broke down in the car park
- b. At least two men broke in and stole my TV
- c. The horses were broken in and ridden in two weeks d Kim and Sandy both broke up with their partners

(2)

- a. The horse which Kim sometimes rides is more bad tempered than mine
- b. The horse as well as the rabbits which we wanted to eat has escaped
- c. It was my aunt’s car which we sold at auction last year in February
- d. The only rabbit that I ever liked was eaten by my parents one summer
- e. The veterans who I thought that we would meet at the reunion were dead

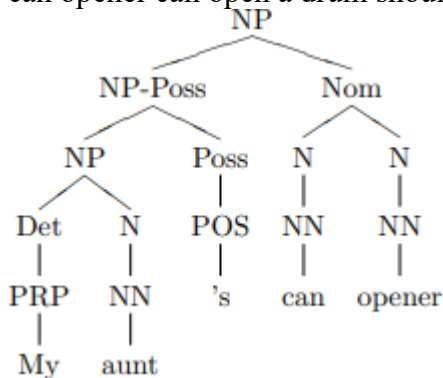
(3)

- a. Natural disasters – storms, flooding, hurricanes – occur infrequently but cause devastation that strains resources to breaking point
- b. Letters delivered on time by old-fashioned means are increasingly rare, so it is as well that that is not the only option available
- c. It won’t rain but there might be snow on high ground if the temperature stays about the same over the next 24 hours

- d. The long and lonely road to redemption begins with self-reflection: the need to delve inwards to deconstruct layers of psychological obfuscation
- e. My wildest dream is to build a POS tagger which processes 10K words per second and uses only 1MB of RAM, but it may prove too hard

Experiment 2: Task phrase-structure tree (PST)

Choose 2 sentences from sets below (4 total) and bracket all the noun phrases (NPs) in each sentence. Then for each NP found, draw a phrase-structure tree (PST) using non-terminal labels (NP, AP etc.) You can invent your own labels for constituents motivated by distributional analysis as necessary, and base your PST on the tokenization and PoS tags assigned in the first handout. For instance the PST analysis of the first two NPs in: My aunt’s can opener can open a drum should look something like this:



Sentences

(1)

- a. The old car broke down in the car park
- b. At least two men broke in and stole my TV
- c. The horses were broken in and ridden in two weeks
- d. Kim and Sandy both broke up with their partners

(2)

- a. The horse which Kim sometimes rides is worse tempered than mine
- b. The horse as well as the rabbits which we wanted to eat have escaped
- c. It was my aunt’s car which we sold at auction last year in February
- d. The only rabbit that I ever liked was eaten by my parents one summer
- e. The veterans who I thought that we would meet at the reunion were dead

Experiment 3: Named entity recognition (NER),

Identifying person, location, and organization names in a given document

Experiment 4: Syntactic analysis of a given document

Experiment 5: Semantic analysis of a given document

Experiment 6: To implement word Sense Disambiguation for a specific scenario using wordnet.

<b>Branch: M.Sc.(C.S.)</b>	<b>SEMESTER-IV</b>
<b>Subject Code: PG4.5</b>	<b>Credit: 04</b>
<b>Subject Title</b>	<b>SWAYAM based MOOC Subject</b>

**Objectives:**

1. To encourage students to self –learn, a course of interest to the students in Computer Science and Application that must be completed in form of certification from Swayam.
2. The Department will approve the list of MOOC course at the beginning of the semester IV.
3. The students will be required to submit the certificate and give a University External Exam of 100 marks.

## Elective-IV

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-IV</b>
<b>Subject Code: PG4.5.1</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective-IV: INFORMATION SECURITY</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>
UNIT-I	1	<b>Symmetric Ciphers</b> : Overview – Services, Mechanism and Attacks, The OSI Security. Architecture, A model for network security Classical Encryption techniques – Symmetric Cipher model, Substitution. Techniques, Transposition techniques, Rotor Machines, Steganography. Block Cipher and Data Encryption Standard – Simplified DES, Block. Cipher principles, The Data Encryption Standard, The strength of DES, Differential and Linear Cryptanalysis, Block Cipher design principles, Block Cipher mode of Operation.	15



UNIT-II	2	<b>Asymmetric Ciphers</b> : Public Key Cryptography and RSA – Principles of Public Key Cryptosystems, The RSA Algorithm Key management ; Other public key cryptosystems – Key Management, Diffe-Hellman Key Exchange, Elliptical Curve Arithmetic, Elliptical curve Cryptography Message Authentication and HASH Functions – Authentication requirements, Authentication Functions, Message Authentication Codes, Hash Functions, security of Hash Functions and MACS Digital Signatures and Authentication Protocols – Digital Signatures, Authentication Protocols, Digital Signature Standard.	15
UNIT-III	3	<b>Network Security practice</b> : Authentication Applications – Kerberos, X.500 Authentication Service Electronic Mail Security – Pretty Good Privacy, S/MIME IP Security – IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating security payload, Combining Security Associations, Key Management WEB Security – Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.	15
UNIT-IV	4	<b>System Security</b> : Intruders – Intruders, Intruder detection, Password Management, Malicious Software – Viruses and Related Threats, Virus Countermeasures, Firewall design principles, Trusted system.	15

**Reference Books:**

- 1) Williams Stallings – Cryptography and Network security principles and practices. Pearson Education (LPE)
- 2) Menezes, A.J., P.C. Van Oorschot, and S.A. Vanstone, “Handbook of Applied Cryptography”
- 3) Schneir, Bruce, “Applied Cryptography : Protocols and Algorithms”

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-III</b>
<b>Subject Code: PG4.5.2</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective IV: DIGITAL FORENCICS</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age</b>
UNIT-I	01	<b>Introduction:</b> Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers’ roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident.	09	10
UNIT-II	02	<b>Initial Response and forensic duplication</b>  Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic.  Duplicate/Qualified Forensic Duplicate of a Hard Drive.	08	20
UNIT-III	03	<b>Preserving and Recovering Digital Evidence</b>  File Systems: FAT, NTFS - Forensic Analysis of File Systems – Storage, Fundamentals: Storage Layer, Hard Drives Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.	09	20
	04	<b>Network Forensics</b>  Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.	07	15
	05	<b>System investigation</b> Data Analysis Techniques - Investigating Live Systems (Windows & 08 Unix) Investigating	08	20
UNIT-		Hacker Tools - Ethical Issues – Cybercrime.		

IV	06	<b>Bodies of law</b> Constitutional law, Criminal law, Civil law, Administrative regulations, Levels of law: Local laws, State laws, Federal laws, International laws , Levels of culpability: Intent, Knowledge, Recklessness, Negligence Level and burden of proof : Criminal versus civil cases ,Vicarious liability, Laws related to computers: CFAA, DMCA, CAN Spam, etc.	09	1 5
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**Reference Books:**

1. Kevin Mandia, Chris Prorise, “Incident Response and computer forensics”, Tata McGrawHill, 2006
2. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001
4. Skoudis. E., Perlman. R. Counter Hack: A Step-by-Step Guide to Computer Attacks and Effective Defenses. Prentice Hall Professional Technical Reference. 2001
5. Norbert Zaenglein, "Disk Detective: Secret You Must Know to Recover Information From a Computer", Paladin Press, 2000
6. Bill Nelson, Amelia Philips and Christopher Steuart, “Guide to computer forensics investigation “Course technology, 4th edition

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-IV</b>
<b>Subject Code: PG4.5.3</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective-IV: Agile Methodology</b>

<b>Branch: M.Sc.(C.S.)</b>	<b>Semester-IV</b>
<b>Subject Code: PG4.5.4</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective-IV: CLOUD COMPUTING</b>

**COURSE OBJECTIVES:**

1. The student will learn how to apply trust-based security model to real-world security problems.
2. An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
3. Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

**COURSE OUTCOMES:**

After completion of course, students would be able to:

1. Identify security aspects of each cloud model
2. Develop a risk-management strategy for moving to the Cloud
3. Implement a public cloud instance using a public cloud service provider
4. Apply trust-based security model to different layer

Modules	Sr. No.	Topic and Details	No of Lectures Assigned
UNIT-I	1	<b>Introduction to Cloud Computing:</b> Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.	15
UNIT-II	2	<b>Cloud Computing Architecture:</b> Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model.	15
	3	<b>Cloud Deployment Models:</b> Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	
UNIT-III	4	<b>Security Issues in Cloud Computing:</b> Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security.	15
	5	<b>Identity and Access Management:</b> Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.	

UNIT-IV	6	<p><b>Security Management in the Cloud:</b> Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS.</p> <p><b>Privacy Issues:</b> Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.</p>	15
	7	<p><b>Audit and Compliance:</b> Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.</p> <p><b>Advanced Topics:</b> Recent developments in hybrid cloud and cloud security.</p>	

**Reference Books:**

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009

Branch: M.Sc.(C.S.)	SEMESTER-IV
Subject Code: PG4.6	Credit: 06
Subject Title	RP / OJT