Scheme & Syllabus of M. Tech (CSE) Programme

Semester IV

S. No.	Subject Code	Board of Study	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2 (L+T+P)
				L	T	P	PRE**		ESE*	Total Marks	
							Mid Sem	TA			
1	SOE-M-CSE-21-401	CSE	Elective VI	3	1	0	30	20	50	100	4
2	SOE-M-CSE-21-402	CSE	Dissertation	0	0	32	0	200	200	400	16
TOTAL				3	1	32	30	220	250	500	20

* End Semester Examination
** Progress Review Examination

Elective-VI

Sl. No	Subject Code	Subject Name
1.	SOE-M-CSE-21-401(1)	Deep Learning and Applications
2.	SOE-M-CSE-21-401(2)	Natural Language Processing
3.	SOE-M-CSE-21-401(3)	Digital Forensics and Malware

L: Lecture, **T:** Tutorial, **P:** Practical, **ESE:** End Semester Examination, **T.A:** Teacher's Assessment.

Programme	**:**	**M. Tech.**	**Semester**	**:**	**4th**
Name of the Course:		**Deep Learning and Applications**	**Course Code:**		**SOE-M-CSE-21-401(1)**
			No of Hours :		**4 Hrs./week**
Credits	**:**	**4**			
Max Marks	**:**	**100**			

Course Description:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. For example, asked to recognize faces, a deep neural network may learn to represent image pixels first with edges, followed by larger shapes, then parts of the face like eyes and ears, and, finally, individual face identities. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain the knowledge about neural networks.
CO2	Introduce the basic concepts and techniques of deep learning.
CO3	Apply optimization techniques in in real life applications.
CO4	Develop the skills in deep learning for solving practical problems. To be familiar with a set of well-known deep neural network, convolutional neural network, filters optimization techniques.
CO5	Apply RNN and LSTM for sentiment analysis

Syllabus:

UNIT-I: Basics of Neural Networks

Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

UNIT-II: Feedforward Networks and Deep Neural Networks

Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders, difficulty of training deep neural networks, Greedy layer wise training.

UNIT-III: Optimization in Deep Neural Network

Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT-IV: Recurrent Neural Network

Back propagation through time, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

UNIT-V: Convolutional Neural Networks:

Convolution in n-dimensions, Convolutional layers, Pooling strategies, Visualization of filters.

Text Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.

Reference Books:

2. Raúl Rojas, "Neural Networks: A Systematic Introduction", 1996.
3. Christopher Bishop , "Pattern Recognition and Machine Learning", 2007.

CO-PO & PSO Correlation

Course Name: Deep Learning and Applications								
	Program Outcomes					PSOs		
Course Outcomes	1	2	3	4	5	1	2	3
CO1:	3	2	2			3	3	3
CO2:	3	2	2			3	3	2
CO3:	2	2	2			2	2	3
CO4:		2	1			1	2	3
CO5:		3	2			1	3	1

Note: 1.: Low 2.: Moderate 3.: High

Programme	**:**	**M. Tech.**	**Semester**	**:**	**4th**
Name of the Course:		**Natural Language Processing**	**Course Code:**		**SOE-M-CSE-21-401(2)**
			No of Hours	**:**	**4 Hrs./week**
Credits	**:**	**4**			
Max Marks	**:**	**100**			

Course Description:
The course will provide foundational knowledge of natural language processing. In the course, basic concepts of language designing, grammars, syntax and semantics and designing of NLP systems will be covered.

Course Outcomes:
After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Tag a given text with basic Language features
CO2	Design an innovative application using NLP components
CO3	Implement a rule-based system to tackle morphology/syntax of a language
CO4	Design a tag set to be used for statistical processing for real-time applications
CO5	Compare and contrast the use of different statistical approaches for different types of NLP applications.

Syllabus:

UNIT-I: Introduction

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT-II: Word Level Analysis

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT-III: Syntactic Analysis

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT-IV: Semantics and Pragmatics

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT-V: Discourse Analysis and Lexical Resources

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O_Reilly Media, 2009.

Reference Books:

1. Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, "Natural Language Processing with Java", O_Reilly Media, 2015
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

CO-PO & PSO Correlation

Course Name: Natural Language Processing								
	Program Outcomes					PSOs		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
CO1:	**3**	**2**	**2**			**3**	**3**	**3**

CO2:	**2**	**3**	**2**			**3**	**3**	**2**
CO3:	**2**	**2**	**2**			**2**	**2**	**3**
CO4:		**2**	**1**			**1**	**3**	**3**
CO5:	**2**		**2**			**1**	**3**	**1**

Note: 1.: Low 2.: Moderate 3.: High

Programme	**:**	**M. Tech.**	**Semester**	**:**	**4th**
Name of the Course:		**Digital Forensics and Malware**	**Course Code:**		**SOE-M-CSE-21-401(3)**
			No of Hours :		**4 Hrs./week**
Credits	**:**	**4**			
Max Marks	**:**	**100**			

Course Description:

This course is designed to introduce the principles and practices generally required to investigate the cyber-crimes. It includes the study of various data acquisition process and tools, evidence analysis procedures and methodologies, taxonomy of digital forensics tools, analysis of network, file signature, data recovery, file system analysis, volatile memory forensics, mobile devices and cloud forensics which are the state-of-the-art requirement in the present and upcoming digital world followed by digital forensics examiner.

Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Understand the scope of digital forensic investigation and severity of crime scene.
CO2	Acquire forensic image of suspected digital device under investigation.
CO3	Examine the evidence using open source and freeware tools.
CO4	Apply different computer forensic tools for conducting forensic analysis.
CO5	Perform investigation practices using different operating systems

Syllabus:

UNIT-I: Basics of Digital Forensics

Fundamentals of Computer forensics investigation, computer forensics versus other related disciplines, A brief History of computer Forensics, benefits of computer forensics, Modern day digital forensics, Introduction to IT Act 2000, Volatile and Non-Volatile Memory, challenges in digital forensics, Strategies for forensics investigations, importance of event reconstruction.

UNIT-II: Memory Analysis

Memory organization concept, Data storage concepts, Disk partition, Data Acquisition and Authentication Process, Non-volatile memory analysis: overview of various File systems (FAT/NTFS/EXT/UFS etc.), data recovery concepts, file search and recovery, file carving approach, Volatile memory analysis: dumping RAM image, RAM analysis, Volatility framework.

UNIT-III: Network Forensics

Introduction to WireShark, Introduction to TCPDump, investigating netrowk traffic, investigating network intrusions, study and analysis of benchmark network traffic dumps, analysis of cyber-attacks, understanding attack signature and behavior, router forensics.

UNIT-IV: Windows Systems and Artifacts

Windows Systems and Artifacts: Introduction, Windows File Systems, Master File Table, NTFS concept and analysis, File System Summary, Registry, Event Logs, USN Journal, Prefetch Files, JumpList, Shortcut Files, Program execution analysis.

UNIT-V: File indexing techniques and current trends in Database

Evaluating Computer Forensics Tool Needs, Introduction to Kali Linux, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensics Tools, Other GUI Forensics Tools, Overview of Computer Forensics Hardware Tools, Forensic Workstations, Use Case of Write-Blocker Case Study: IoT device forensics, Drone Forensics, Smart TV Forensics, Gaming Console Forensics etc.

Text Books:

1. File System Forensic Analysis, by Brian Carrier Pearson Education.
2. Handbook of Digital Forensics and Investigation, Eoghan Casey, 1st edition, Academic Press.
3. Practical Linux Forensics: A Guide for Digital Investigators, by Bruce Nikkle, No Starch Press.

Reference Books:

1. Mangesh M. Ghonge, Sabyasachi Pramanik, Ramchandra Mangrulkar, Dac-Nhuong Le, “Cyber Security and Digital Forensics: Challenges and Future Trends”, Wiley- Scrivener.
2. Greg Gogolin, “Digital Forensics Explained”, CRC Press/Taylor & Francis Group, 2nd Edition.

CO-PO & PSO Correlation

Course Name: Digital Forensics and Malware								
	Program Outcomes					**PSOs**		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
CO1:	**3**	**3**	**2**			**3**	**3**	**3**
CO2:	**1**	**2**	**2**			**3**	**3**	**2**
CO3:	**2**	**2**	**2**			**2**	**2**	**3**
CO4:			**1**			**1**	**3**	**3**
CO5:		**3**	**2**			**1**	**3**	**1**

Note: 1.: Low 2.: Moderate 3.: High

Programme	**:**	**M. Tech.**	**Semester**	**:**	**4th**
Name of the Course:		**Dissertation-Phase-II**	**Course Code:**		**SOE-M-CSE402**
Credits	**:**	**16**	**No of Hours**	**:**	**16 Hrs./week**
Max Marks	**:**	**400**			

Course Description:

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or application based project on any of the topics. Each project will submit project synopsis by the end of the semester. Project evaluation committee consisting of three or four faculty members specialized in the various fields shall study the feasibility of each project work before giving consent.

Course Outcomes:

After Completion of the course Students will be able to:

CO Number	Course Outcome
CO1	Gain in-depth knowledge and use adequate methods in the major subject/field of study.
CO2	Create, analyze and critically evaluate different technical/research solutions
CO3	Clearly present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings
CO4	Identify the issues that must be addressed within the framework of the specific dissertation in order to take into consideration
CO5	Apply principles of ethics and standards, skill of presentation and communication techniques.

Contents

Project work is of duration of one semesters and is expected to be completed in this semester. Each student is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The student is expected to fix their topics, complete preliminary studies like literature survey, field measurements etc. in the third semester.

Student shall study the topic of project work and define problem statement. The student shall evolve design and/or do experimental study and/or obtain solution to the identified problem. The student shall prepare a report and shall present a seminar on the basis of work done at the end of semester.

CO-PO & PSO Correlation

Course Name: Dissertation-Phase II								
	Program Outcomes					PSOs		
Course Outcomes	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**
CO1:	**3**		**2**	**2**	**3**	**3**	**3**	**3**
CO2:	**1**		**2**	**2**	**3**	**3**	**3**	**2**
CO3:	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**3**
CO4:		**2**	**1**	**2**	**3**	**1**	**2**	**3**
CO5:		**3**	**2**	**3**	**3**	**1**	**3**	**1**

Note: 1.: Low 2.: Moderate 3.: High