SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Information Technology
Syllabus applicable to July 2022 admitted

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7thSemester
Subject Category	Engineering Science Course (DC)
Subject Code: AI-701	Subject Name: **Deep Learning**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

Introduction to machine learning, data science

Course Objective:

This course will introduce the theoretical foundations, algorithms, methodologies, and applications of neural networks and deep learning. It will help to design and develop application-specific deep learning models and also provide the practical knowledge handling and analysing real world applications.

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

CO1. Have a good understanding of the fundamental issues and basics of machine learning.
CO2. Ability to differentiate the concept of machine learning with deep learning techniques.
CO3. Understand the concept of CNN and transfer learning techniques, to apply it in the classification problems
CO4. Learned to use RNN for language modelling and time series prediction.
CO5. Use auto encoder and deep generative models to solve problems with high dimensional data including text, image and speech.

UNITs	Descriptions	Hrs.	CO's
I	**Machine Learning Basics:** Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.	8	1
II	**Introduction to Deep Learning & Architectures** Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders.	**7**	2
III	**Convolutional Neural Networks** Architectural Overview – Motivation - Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: ResNet, AlexNet.	8	3
IV	**Transfer Learning** Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet. **Sequence Modelling – Recurrent and Recursive Nets**	8	4

	Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architechures - BPTT for training RNN, Long Short Term Memory Networks.		
V	**Auto Encoders:** Under complete Autoencoders – Regulraized Autoencoders – stochastic Encoders and Decoders – Contractive Encoders **Deep Generative Models:** Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine - Generative Adversial Networks. RecentTrends	9	5
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Classification with Multilayer Perceptron using Scikit-learn (MNIST Dataset) 3 hours
2. Hyper-Parameter Tuning in Multilayer Perceptron 3 hours
3. Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch 2 hours
4. Classification of MNIST Dataset using CNN 2 hours
5. Parameter Tuning in CNN 2 hours
6. Sentiment Analysis using CNN 2 hours
7. Face recognition using CNN 2 hours
8. Object detection using Transfer Learning of CNN architectures 2 hours
9. Recommendation system using Deep Learning 2 hours
10. Dimensionality Reduction using Deep learning 2 hours
11. Language Modeling using RNN 2 hours
12. Time Series Prediction using RNN 2 hours
13. Sentiment Analysis using LSTM 2 hours
14. Image generation using GAN 2 hours

Total Laboratory Hours 30 hours

Text Book-

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017

Reference Books-

1. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
2. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
3. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
4. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
5. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
6. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

List and Links of e-learning resources:

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical

examinations.

COs	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1	PO11	PO12	PSO 1	PSO 2
CO-1	1	1									3	3	3	2
CO-2	1		1	2							2	1	3	2
CO-3	2	1									2	2	1	2
CO-4	3	2	3	2	1			1	2		3		3	1
CO-5	3	3	2	1				2		2	2	3	1	1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

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Department of Information Technology

Syllabus applicable to July 2022 admitted

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4rd Year 7thSemester
Subject Category	Engineering Science Course (DE-IV)
Subject Code: AI-702(A)	Subject Name: **Introduction to Logics**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work		L	T	P	
60	20	10	10			100	3	0	-	3

Prerequisites:

Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

1

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

CO1.

UNITs	Descriptions	Hrs.	CO's
I	Creating Motivation for the Study of Logic, Sets, Relations and Functions, Operations on Binary Relations, Ordering Relations, Partial Orders and Trees, Infinite Sets: Countability and Uncountability .	8	1
II	Induction Principles Mathematical Induction Mathematical Induction Complete Induction inductive definitions Structural Induction Universe constructor depth of construction , elements rules generation	8	2
III	Propositional Logic Syntax of Propositional Logic The model of truth Semantics of Propositional Logic , boolean algebra Satisfiability, Validity and Contingency contradiction.	8	3
IV	An Axiomatic Theory for Propositional Logic a deductive system pattern substitution rules complete system. Formal theories inference rules Monotonicity Compactness Substitutivity Hilbert-style Proof System Proof tree for theorem Natural Deduction Proof System,Derived Operators Derived Inference Consistency, completeness and decidability Compactness, Propositional Resolution	10	4
V	Resolution in Propositional Logic: Introduction, procedure Space Complexity, Time Complexity, procedure resolution, cleanup operations Undecidability : Introduction Representability Godel's Incompleteness Theorem Second-Order Logic	8	5
Guest Lectures (if any)		Nil	
Total Hours		42	

Suggestive list of experiments:

NO Lab

Text Book-

1. Introduction to Logic for Computer Science,S. Arun-Kumar

Reference Books-

1. Logic in Computer Science: Modeling and Reasoning about Systems (2nd edition), Huth and Ryan, Cambridge
2. Logic for Computer Science Steve Reeves and Michael Clarke. Addison-Wesley, 1990. ISBN: 0-201-41643-3
3. Logic for Computer Science. Jean H. Gallier. Harper and Row, New York, 1986.
4. First-Order Logic and Automated Theorem Proving. Melvin Fitting. Springer Verlag, Berlin, 1990.
5. A Mathematical Introduction to Logic. Herbert B. Enderton. Academic Press, New York, 1972.
6. Natural Deduction (A Proof-theoretical study). Dag Prawitz. Almqvist and Wiskell, 1965.

List and Links of e-learning resources:

1. https://nptel.ac.in/courses/117103063/
2. http://www.public.asu.edu/~yzhan442/teaching/CSE259F19-LCS
3. http://www.wikihow.com/Email-a-Professor.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO1	2	1	2										1	1
CO2	2	1	2										1	1
CO3	2	1	2										1	2
CO4	2	2	2										1	2
CO5	1	2	2	1	2								2	1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

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Department of Information Technology

Syllabus applicable to July 2022 admitted onwards

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7th Semester
Subject Category	Professional Elective courses (DE-IV)
SubjectCode: AI-702(B)	Subject Name: **Natural Langugae Processing**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work		L	T	P	
60	20	10	10	-	-	100	3	-	-	3

Prerequisites:

Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

1 Natural language processing deals with written text.
2 Learn how to process written text from basic of fundamental knowledge.
3 Regular expression and probabilistic model with n-grams.
4 Recognizing Speech and parsing with grammar.

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

CO1: Understand comprehend the key concepts of NLP and identify the NLP challenges and issues.
CO2: Develop Language Modelling for various text corpora across the different languages
CO3: Illustrate computational methods to understand language phenomena of word sense disambiguation.
CO4: Design and develop applications for text or information extraction/summarization/classification
CO5: Apply different Machine translation techniques for translating a source to target language(s).

UNITs	Descriptions	Hrs.	CO's
I	Introduction to NLP: History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, build an NLP pipeline , Phases of NLP, NLP APIs, NLP Libraries.	8	1
II	Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition	8	2
III	Words and Word Forms: Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation.	8	3
IV	Text Analysis, Summarization and Extraction: Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR	8	4
V	Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation (SMT), Parameter learning in SMT (IBM models) using EM), Encoder-decoder architecture, Neural Machine Translation.	8	5
Guest Lectures (if any)		Nil	
Total Hours		40	

Suggestive list of experiments:
NO LAB
Text Book- 1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
Reference Books- 1.Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press 1. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing 3. Natural Language Processing with Python – Analyzing Text with the Natural Language ToolkitSteven Bird, Ewan Klein, and Edward Loper.
List and Links of e-learning resources: 1. https://www.kaggle.com/learn/natural-language-processing 2. https://www.javatpoint.com/nlp 3. https://nptel.ac.in/
Modes of Evaluation and Rubric
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1		2			2							2	1	2
CO-2	2	3		2	1						1	2	3	3
CO-3	2	3	3	2								2	2	2
CO-4	2	2		2								2	3	3
CO-5	2	2	2									2	3	3

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

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Department of Information Technology
Syllabus applicable to July 2022 admitted

Semester/Year		7th /4-year		Program		B.Tech. AIADS
Subject Category	DE-IV	Subject Code:	AI-702(C)	Subject Name:		Business Intelligence

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment/Quiz		End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10				100	3	-	-	3

Prerequisites:

Basic understanding of database systems and software engineering.

Course Objective:

The objective of this course is to understand the basic concepts of business intelligence, probability and statistics. To impart the knowledge of BI tools. To familiarize students with the Data Warehousing. The course will help student to understand the problems of current scenario and design of the business solutions.

Course Outcomes:

Upon completion of this course, the student will be able to:
CO1: Familiarize the importance of business intelligence for organizations.
CO2: Understand and apply basic concepts of Probability.
CO3: Understand and analyze baye's theorem and its applications
CO4: Develop data warehouse for a domain using Data warehouse tools. Operate data warehouse to meet business objectives.
CO5: Understand the concept of designing data warehouse models using appropriate schemas.

UNITs	Descriptions	Hrs.	CO's
I	**Business Intelligence Introduction** - Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence, Types of Data, The measure of Central Tendency, Measure of Spread, Standard Normal Distribution, Skewness, Measures of relationship, Central Limit Theorem.	7	CO1
II	**Basic Probability** -- definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, probability mass function, continuous random variable, Probability Density Function, Cumulative Distributive Function, properties of	6	CO2

	cumulative distribution function, Two dimensional random variables and their distribution functions, Marginal probability function, Independent random variables.		
III	**Bayesian Analysis** – Bayes Theorem, Applications of Bayes Theorem, Decision Theoretic framework and major concepts of Bayesian Analysis Likelihood, Prior and posterior, Loss function, Bayes Rule, One-parameter Bayesian models. Bayesian Machine Learning- Hierarchical Bayesian Model, Regression with Ridge prior, Classification with Bayesian Logistic Regression	8	CO3
IV	**Data Warehousing (DW)**- Introduction & Overview; Data Marts, DW architecture - DW components, Implementation options; Meta Data, Information delivery. ETL - Data Extraction, Data Transformation - Conditioning, Scrubbing, Merging, etc., Data Loading, Data Staging, Data Quality.	7	CO4
V	**Dimensional Modeling** - Facts, dimensions, measures, examples; Schema Design Star and Snowflake, Fact constellation, Slow changing Dimensions. OLAP - OLAP Vs OLTP, Multi-Dimensional Databases (MDD); OLAP MOLAP, HOLAP; ROLAP, Data Warehouse Project Management - Critical issues in planning, physical design process, deployment and ongoing maintenance.	7	CO5
Guest Lectures (if any)		May be arranged as required	
Total Hours		**35**	

Text Book-

- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
- D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley
- David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
- Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.

Reference Books-

- Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
- Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
- David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
- Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.
- Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.

Modes of Evaluation and Rubric
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.
List/Links of e-learning resource

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_1**	**PO_{11}**	**PO_{12}**	**PSO1**	**PSO2**
CO-1	3	2											3	
CO-2	3	3			1								2	
CO-3	3	3	1		1							3		3
CO-4	3	3	2	1								1		3
CO-5	3	3										1	2	

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar
Subject handled by department	IT

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Department of Information Technology

Syllabus applicable to July 2022 admitted

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7thSemester
Subject Category	Engineering Science Course DE-V
Subject Code: AI-703(A)	Subject Name: **Big Data Analytics**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		**Total Marks**				
End Sem	Mid-Sem	ASS	QUIZ	End Sem	Lab-Work		L	T	P	
60	20	10	10				3	-		3

Prerequisites:

Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Objective:

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hodoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

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

CO1: Identify Big Data and its Business Implications.
CO2: List the components of Hadoop and Hadoop Eco-System
CO3: Access and Process Data on Distributed File System
CO4: Manage Job Execution in Hadoop Environment
CO5: Develop Big Data Solutions using Hadoop Eco System & apply Machine Learning Techniques using R.

UNITs	Descriptions	Hrs.	CO's
I	**UNIT I : INTRODUCTION TO BIG DATA AND HADOOP** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	8	1
II	**UNIT II : HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	8	2
III	**UNIT III : Map Reduce** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	8	3
IV	**Hadoop Eco System** **Pig :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive :** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.	8	4

	Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **Big SQL** : Introduction		
V	**Data Analytics with R** Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	8	5
Guest Lectures (if any)			
Total Hours 40		40	

Suggestive list of experiments:

Text Book-

Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

• Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books-

Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

• Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

• Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

• Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007

• Pete Warden, "Big Data Glossary", O'Reily, 2011.

• Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

• ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

• Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

List and Links of e-learning resources:

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	3	2	2										1	2
CO-3	2	1	2		2								1	2
CO-4	2	1	2											2
CO-5	2	2	2											1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

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Department of Information Technology

Syllabus applicable to July 2022 admitted onwards

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7thSemester
Subject Category	Engineering Science Course (DE-V)
SubjectCode: AI-703(B)	Subject Name: **Data Visualization and Handling**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		**Total Marks**				
End Sem	Mid-Sem	Quiz	Assi	End Sem	Lab-Work		L	T	P	
60	20	10	10			100	3	-		3

Prerequisites:

Basic Knowledge of algorithms, Discrete Mathematics

Course Objective:

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

CO1. Describe a flow process for data science problems (Remembering)
CO2. Classify data science problems into standard typology (Comprehension)
CO3. Develop R codes for data science solutions (Application)
CO4. Correlate results to the solution approach followed (Analysis)
CO5. Assess the solution approach (Evaluation).

UNITs	Descriptions	Hrs.	CO's
I	Introduction to data visualization and why it is important Basic principles of good data visualization design Common types of charts and graphs and when to use them Gathering and cleaning data	8	1
II	Exploratory data analysis and visualization Advanced data visualization techniques and tools, such as interactive charts and maps Creating effective dashboards and visual storytelling with data Data visualization ethics and avoiding common pitfalls.	8	2
III	Introduction to data handling techniques, such as filtering and sorting data, merging, and reshaping data sets, and working with missing data Introduction to programming concepts for data handling, such as loops and functions, and using tools such as Python or R for data analysis and visualization	8	3
IV	Introduction to ELK and the Elastic Stack Installing and setting up ELK Gathering and parsing log data with Logstash Storing and indexing data in Elastic search Visualizing data with Kibana.	8	4
V	Creating and sharing dashboards in Kibana Advanced Kibana features, such as saved searches and visualizations, and the time lion visualization tool Integrating ELK with other tools and platforms Scaling and managing an ELK deployment Tips and best practices for using ELK effectively.	8	5

Guest Lectures (if any)		Nil	
Total Hours		40	

Suggestive list of experiments:

NO Lab

Text Book-

1. Data Visualization: A Practical Introduction" by Kieran Healy

Reference Books-

1. Mastering Kibana 6.x" by Pranav Shukla and Sharath Kumar M N
2. Elastic Stack 7.x: Up and Running" by Grant S. Sayer and Robert E. Beatty
3. Kibana Essentials" by Pranav Shukla
4. Data Wrangling with Python" by Jacqueline Kazil and David Beazley

List and Links of e-learning resources:

1.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2										1	2
CO-2	3	2	2										1	2
CO-3	2	1	2		2								1	2
CO-4	2	1	2											2
CO-5	2	2	2											1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

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Syllabus applicable to July 2022 admitted onwards

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7th Semester
Subject Category	Engineering Science Course (DE-V)
SubjectCode: AI-703(C)	Subject Name: **Software Testing & Quality Assurance**

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		**Total Marks**				
End Sem	Mid-Sem	Quiz	Assi	End Sem	Lab-Work		L	T	P	
60	20	10	10			100	3	-		3

Prerequisites:

Basic Knowledge of software design & development.

Course Objective:

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

CO1. Understand the fundamental principles of software testing.
CO2. Learn to create effective test cases & Test plans.
CO3. Develops skills in test execution & analysis.
CO4. Understand the role of test tools.
CO5. Apply industry best practices for software testing.

UNITs	Descriptions	Hrs.	CO's
I	Basics of software testing, Testing objectives, Principles of testing, Requirements, behaviour and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.	8	1
II	White box testing, static testing, static analysis tools, Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, state/graph based testing, Model based testing and model checking, Differences between white box and Black box testing.	8	2
III	Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.	8	3
IV	Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems.	8	4
V	Quality Assurance process & activity, code reviews & inspections, static analysis & code coverage, test driven development and agile testing, emerging trends in software testing.	8	5

Guest Lectures (if any)	Nil	
Total Hours	40	

Suggestive list of experiments:

NO Lab

Text Book-

Reference Books-

1. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
2. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.
3. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley
4. K. K. Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publication.

List and Links of e-learning resources:

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	1	1	2		2							2	1	2
CO-2	3	2	2										1	2
CO-3	2	1	2		2								1	2
CO-4	2	1	2											2
CO-5	2	2	2								1			1

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Information Technology

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7th Semester
Subject Category	Engineering Science Course (DE-VI)
Subject Code: AI-704 (A)	Subject Name: Artificial Intelligence: Knowledge representation and reasoning

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10					100	3			3

Prerequisites:

Formal languages, logic and programming

Course Objective:

An intelligent agent needs to be able to solve problems in its world. The ability to create representations of the domain of interest and reason with these representations is a key to intelligence. In this course we explore a variety of representation formalism's and the associated algorithms for reasoning. We start with a simple language of propositions, and move on to first order logic, and then to representations for reasoning about action, change, situations, and about other agents in incomplete information situations.

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

CO1. Have a good understanding of the propositional logic and basics of Tableau.
CO2. Ability to differentiate the concept of backward and forward chaining.
CO3. Understand the concept of Horn Clauses and Logic Programming
CO4. Learned to use first order logic and apply default reasoning.
CO5. Use circumscription and epistemic logic.

UNITs	Descriptions	Hrs.	CO's
I	Introduction. History and Philosophy. Symbolic Reasoning. Truth, Logic, and Provability. Propositional Logic. Direct Proofs. The Tableau Method.	8	1
II	First Order Logic. Universal Instantiation. The Unification Algorithm. Forward and Backward Chaining. The Resolution Refutation Method.	7	2
III	Horn Clauses and Logic Programming. Prolog. Rule Based Systems. The OPS5 Language. The Rete Algorithm.	8	3
IV	Representation in First Order Logic. Conceptual Dependency. Frames. Description. Logics and the Web Ontology Language. Taxonomies and Inheritance. Default Reasoning.	8	4
V	Circumscription. Auto-epistemic Reasoning. Event Calculus. Epistemic Logic. Knowledge and Belief.	9	5
Guest Lectures (if any)			
Total Hours		40	

Text Book-

Reference Books-

List and Links of e-learning resources:https://nptel.ac.in/courses/106106140

Modes of Evaluation and Rubric
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	**1**	**1**	**2**		**2**							**2**	**1**	**2**
CO-2	**3**	**2**	**2**										**1**	**2**
CO-3	**2**	**1**	**2**		**2**								**1**	**2**
CO-4	**2**	**1**	**2**											**2**
CO-5	**2**	**2**	**2**								**1**			**1**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Information Technology

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7th Semester
Subject Category	Engineering Science Course (DE-VI)
Subject Code: AI-704 (B)	Subject Name: Fuzzy Sets, Logic and Systems & Applications

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10					100	3			3

Prerequisites:

Linear Algebra, Calculus, Basic Programming

Course Objective:

The course is designed to give a solid grounding of fundamental concepts of fuzzy logic and its applications. The level of the course is chosen to be such that all students aspiring to be a part of computational intelligence directly or indirectly in near future should get these concepts.

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

CO1. Understand the concept of fuzzy sets theory.
CO2. Learn to create fuzzy relations.
CO3. Develops fuzzy interface systems.
CO4. Understand the Wang and Mendel Model.
CO5. Apply fuzzifiers and defuzzifiers in machine learning.

UNITs	Descriptions	Hrs.	CO's
I	Introduction and Fuzzy Sets Theory. Membership Functions	8	1
II	Set Theoretic Operations. Fuzzy Arithmetic. Fuzzy Relations	**7**	2
III	Fuzzy Inference Systems I. Fuzzy Inference Systems II	8	3
IV	Wang and Mendel Model. TSK Model	8	4
V	Fuzzifiers and Defuzzifiers. ANFIS Architecture Fuzzy Systems and Machine Learning	9	5
Guest Lectures (if any)			
Total Hours		40	

Text Book-

Reference Books-

List and Links of e-learning resources:https://nptel.ac.in/courses/108104157

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_1**	**PO_{11}**	**PO_{12}**	**PSO1**	**PSO2**
CO-1	**1**	**1**									**3**	**3**	**3**	**2**
CO-2	**1**		**1**	**2**							**2**	**1**	**3**	**2**
CO-3	**2**	**1**									**2**	**2**	**1**	**2**
CO-4	**3**	**2**	**3**	**2**	**1**			**1**	**2**		**3**		**3**	**1**
CO-5	**3**	**3**	**2**	**1**				**2**		**2**	**2**	**3**	**1**	**1**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Department of Information Technology

Name of the course:	B. Tech in **Artificial Intelligence and Data Science**
Semester and Year of study	B. Tech 4th Year 7th Semester
Subject Category	Engineering Science Course (DE-VI)
Subject Code: AI-704 (C)	Subject Name: Optimisation for Machine Learning: Theory and Implementation

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	Assign	End Sem	Lab-Work	Quiz		L	T	P	
70	20	10					100	3			3

Prerequisites:

Linear Algebra, Calculus, Basic Programming

Course Objective:

Optimisation is the workhorse of machine learning. Knowing optimisation is a key prerequisite in understanding theory and practise of machine learning. In this course, we will discuss the foundations required for solving optimization problems in the context of machine learning through various case-studies/running-examples. We will start with covering the basics of linear algebra and calculus required for learning optimization theory. We will learn both the theory and implement optimization algorithms like stochastic gradient descent and its various variants to solve machine learning problems of classification, clustering etc using standard problem formulations which are convex (SVM etc) and non-convex (Neural Networks and Deep Neural Networks) etc.

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

CO1. Describe a basics of linear algebra and calculus.
CO2. Classify convex and non convex optimization problems.
CO3. Develop gradient descent.
CO4. Correlate variants of gradient descent and train a neural network.
CO5. Assess the newton's method.

UNITs	Descriptions	Hrs.	CO's
I	Basics of Linear Algebra and Calculus: Subspaces, EigenValue Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus	8	1
II	Convex Functions, First and Second Order Conditions for Optimisations, Convex and Non Convex Optimisation problems in Machine Learning.	**7**	2
III	Gradient Descent: math, programming basic optimisation problems and their solutions	8	3
IV	Variants of Gradient Descent: Projected, Stochastic, Proximal, Accelerated, Coordinate Descent, Training a Neural Network: Theory	8	4
V	Newton's Method, Optimization for ML in practice: Pytorch/Tensor Flow. Training a Neural Network, Implementation	9	5
Guest Lectures (if any)			
Total Hours		40	

Text Book-

Reference Books-

List and Links of e-learning resources:https://nptel.ac.in/courses/106106245

Modes of Evaluation and Rubric														
The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.														
COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_1**	**PO_{11}**	**PO_{12}**	**PSO1**	**PSO2**
CO-1	**1**	**1**	**2**										**1**	**2**
CO-2	**3**	**2**	**2**										**1**	**2**
CO-3	**2**	**1**	**2**		**2**								**1**	**2**
CO-4	**2**	**1**	**2**											**2**
CO-5	**2**	**2**	**2**											**1**

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Ramratan Ahirwal & Rashi Kumar