Scheme & Syllabus of

UNDERGRADUATE DEGREE COURSE

B.Tech. VII & VIII Semester

Artificial Intelligence and Data Science

Rajasthan Technical University, Kota

Effective from session: 2020-21 Onwards

Teaching & Examination Scheme

B.Tech. : Artificial Intelligence and Data Science

4th Year - VII Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
THEORY											
1	PCC	7AID4-01	Big Data Analytics	3	0	0	3	30	70	**100**	**3**
2	OE		Open Elective – I	3	0	0	3	30	70	**100**	**3**
			Sub Total	**6**	**0**	**0**	**6**	**60**	**140**	**200**	**6**
PRACTICAL & SESSIONAL											
3	PCC	7AID4-21	Big Data Analytics Lab	0	0	4	2	60	40	**100**	**2**
4	PCC	7AID4-22	R. Programming Lab	0	0	4	2	60	40	**100**	**2**
6	PSIT	7AID7-30	Industrial Training	1	0	0		60	40	**100**	**2.5**
7	PSIT	7AID7-40	Seminar	2	0	0		60	40	**100**	**2**
8	SODECA	7AID8-00	Social Outreach, Discipline &Extra Curricular Activities						100	**100**	**0.5**
			Sub- Total	**3**	**0**	**8**	**4**	**240**	**260**	**500**	**9**
			TOTAL OF VII SEMESTER	**9**	**0**	**8**	**10**	**300**	**400**	**700**	**15**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*
ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

Teaching & Examination Scheme

B.Tech. : Artificial Intelligence & Data Science

4th Year – VIII Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
THEORY											
1	PCC	8AID4-01	Deep Learning and Its Applications	3	0	0	3	30	70	**100**	**3**
2	OE		Open Elective – II	3	0	0	3	30	70	**100**	**3**
		Sub Total		**6**	**0**	**0**	**6**	**60**	**140**	**200**	**6**
PRACTICAL & SESSIONAL											
3	PCC	8AID4-21	Deep Learning and Its Application Lab	0	0	2	2	60	40	**100**	**1**
4		8AID4-22	Robot Programing Lab	0	0	2	2	60	40	**100**	**1**
5	PSIT	8AID7-50	Project	3	0	0		60	40	**100**	**7**
6	SODECA	8AID8-00	Social Outreach, Discipline &Extra Curricular Activities						100	**100**	**0.5**
		Sub- Total		**3**	**0**	**4**	**4**	**180**	**220**	**400**	**9.5**
		TOTAL OF VIII SEMESTER		**9**	**0**	**4**	**10**	**240**	**360**	**600**	**15.5**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

List and syllabus for Open Electives (AIDS)

Subject Code	Title		Subject Code	Title
Open Elective - I			**Open Elective - II**	
7AG6-60.1	Human Engineering and Safety		8AG6-60.1	Energy Management
7AG6-60.2	Environmental Engineeringand Disaster Management		8AG6-60.2	Waste and By-product Utilization
7CAI6-60.1	Foundation of Computer Vision		8AN6-60.1	Finite Element Methods
7AN6-60.1	Aircraft Avionic System		8AN6-60.2	Factor of Human Interactions
7AN6-60.2	Non-Destructive Testing		8CH6-60.1	Refinery Engineering Design
7CH6-60.1	Optimization Techniques		8CH6-60.2	Fertilizer Technology
7CH6-60.2	Sustainable Engineering		8CR6-60.1	Electrical and Electronic Ceramics
7CR6-60.1	Introduction to Ceramic Science & Technology		8CR6-60.2	Biomaterials
7CR6-60.2	Plant, Equipment and Furnace Design		8CE6-60.1	Composite Materials
7CE6-60.1	Environmental Impact Analysis		8CE6-60.2	Fire and Safety Engineering
7CE6-60.2	Disaster Management		8EE6-60.1	Energy Audit and Demand side Management
7EE6-60.1	Electrical Machines and Drives		8EE6-60.2	Soft Computing
7EE6-60.2	Power Generation Sources.		8EC6-60.1	Industrial and Biomedical applications of RF Energy
7EC6-60.1	Principle of Electronic communication		8EC6-60.2	Robotics and control
7EC6-60.2	Micro and Smart System Technology		8ME6-60.1	Operations Research
7ME6-60.1	Finite Element Analysis		8ME6-60.2	Simulation Modeling and Analysis
7ME6-60.2	Quality Management		8MI6-60.1	Experimental Stress Analysis
7MI6-60.1	Rock Engineering		8MI6-60.2	Maintenance Management
7MI6-60.2	Mineral Processing		8PE6-60.1	Unconventional Hydrocarbon Resources
7PE6-60.1	Pipeline Engineering		8PE6-60.2	Energy Management & Policy
7PE6-60.2	Water Pollution control Engineering		8TT6-60.1	Material and Human Resource Management
7TT6-60.1	Technical Textiles		8TT6-60.2	Disaster Management
7TT6-60.2	Garment Manufacturing Technology			

7AID4-01: Big Data Analytics

Credit: 3 **Max. Marks: 100 (IA:30, ETE:70)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Introduction to Big Data:** Big data features and challenges, Problems with Traditional Large-Scale System, Sources of Big Data, 3 V's of Big Data, Types of Data. Working with Big Data: Google File System. Hadoop Distributed File System (HDFS) - Building blocks of Hadoop (Namenode. Data node. Secondary Namenode. Job Tracker. Task Tracker), Introducing and Configuring Hadoop cluster (Local. Pseudo-distributed mode, Fully Distributed mode). Configuring XML files.	10
3	**Writing MapReduce Programs:** A Weather Dataset. Understanding Hadoop API for MapReduce Framework (Old and New). Basic programs of Hadoop MapReduce: Driver code. Mapper code, Reducer code. Record Reader, Combiner, Partitioner.	08
4	**Hadoop I/O:** The Writable Interface. Writable Comparable and comparators. Writable Classes: Writable wrappers for Java primitives. Text. Bytes Writable. Null Writable, Object Writable and Generic Writable. Writable collections. Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators.	08
5	**Pig:** Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow. Working through the ABCs of Pig Latin. Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.	07
6	**Applying Structure to Hadoop Data with Hive:** Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive. Examining the Hive Clients. Working with Hive Data Types. Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.	06
	Total	40

TEXT BOOK	
1	Saumyadipta Pyne "Big Data Analytics: Methods and Applications"
2	Simon Cleveland "Big Data Analytics: Tools and Technology for Effective Planning"
3	Tom White "Hadoop: The Definitive Guide"
REFERENCE BOOKS	
1	Thomas H. Davenport "Big Data at Work: Dispelling the Myths, Uncovering the Opportunities" Harvard Business Review Press
2	Foster Provost and Tom Fawcett "Data Science for Business" O'Reilly Media
3	Jure Leskovec, Anand Rajaraman, and Jeffrey D. Ullman "Mining of Massive Datasets" Cambridge University Press

7AID4-21: Big Data Analytics Lab

Credit: 2 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 2 Hours**

SN	List of Experiments
1	Implement the following Data structures in Java i) Linked Lists ii) Stacks iii) Queues iv) Set v) Map
2	Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudodistributed, Fully distributed.
3	Implement the following file management tasks in Hadoop: • Adding files and directories • Retrieving files • Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
4	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5	Write a Map Reduce program that mines weather data. Weather sensors collecting data everyhour at many locations across the globe gather a large volume of log data, which is a goodcandidate for analysis with MapReduce, since it is semi structured and record-oriented.
6	Implement Matrix Multiplication with Hadoop Map Reduce
7	Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
8	Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
9	Solve some real life big data problems.

REFERENCE BOOKS	
1	Ted Malaska and Jonathan Seidman "Hadoop Application Architectures"
2	Nathan Marz and James Warren"Big Data: Principles and best practices of scalable realtime data systems"
3	John W. Foreman "Data Smart: Using Data Science to Transform Information into Insight"

7AID4-22: R. Programming Lab

Credit: 2 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 2 Hours**

SN	List of Experiments
1	**Basic R Syntax and Data Structures**: Explore basic arithmetic operations and variable assignment, Practice creating and manipulating vectors, matrices, and lists , Perform indexing and slicing on data structures.
2	**Data Import and Cleaning**: Import data from a CSV file, Excel spreadsheet, or JSON file. Clean the dataset by handling missing values and outliers.
3	**Data Visualization using ggplot2**: Create scatter plots, bar charts, and histograms using ggplot2. Customize plot aesthetics like titles, labels, and colors.
4	**Exploratory Data Analysis**: Calculate summary statistics (mean, median, standard deviation). Create box plots and violin plots to visualize distribution.
5	**Hypothesis Testing:** Perform t-tests and chi-square tests on relevant datasets. Interpret p-values and draw conclusions.
6	**Clustering and Dimensionality Reduction**: Apply k-means clustering to segment data. Perform principal component analysis (PCA) for dimensionality reduction.
7	**Machine Learning Exploration:** Apply a basic machine learning algorithm (e.g., decision tree) on a dataset. Evaluate model performance and visualize results.
8	**Linear Regression and Visualization:** Fit a linear regression model to a dataset. Visualize the regression line along with the data points.
9	**Web Scraping and Data Collection:** Use libraries like rvest to scrape data from websites. Collect and clean data from multiple sources for analysis.

REFERENCE BOOKS	
1	Hadley Wickham, Garrett Grolemund, "R for Data Science", O'Reilly Media
2	Norman Matloff, "The Art of R Programming" No Starch Press
3	Garrett Grolemund "Hands-On Programming with R",O'Reilly Media

8AID4-01: Deep Learning and Its Applications

Credit: 3 **Max. Marks: 100 (IA:30, ETE:70)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Deep Networks 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, Deep feed forward networks.	08
3	**Deep Learning Architectures:** Machine Learning and Deep learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU,LRELU,ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.	08
4	**Convolutional Neural Networks:** Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, Alexnet –Applications.	07
5	**Sequence Modelling-Recurrent And Recursive Nets:** Recurrent Neural Networks, Bidirectional RNNs, Encoder –decoder sequence to sequence architectures – BPTT for training RNN, Long Short Term Memory Networks. Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.	09
6	**Auto Encoders:** Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders.	07
	Total	40

TEXT BOOK	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016 .
2	Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015
3	Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009
4	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	Antonio Gulli, Sujit Pal “Deep Learning with Keras” Pact Publishers, 2017
3	Francois Chollet “Deep Learning with Python”, Manning Publications, 2017

8AID4-21: Deep Learning and Its Application Lab

Credit: 1 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+2P **End Term Exam: 2 Hours**

SN	List of Experiments
1	Build a deep neural network model start with linear regression using a) Single variable *b)* Multiple variables
2	Write a program to convert : a) Speech into text b) Text into speech c) Video into frames
3	Build a feed forward neural network for prediction of logic gates.
4	Write a program for character recognition using: a) CNN b) RNN
5	Write a program to predict a caption for a sample image using : a) LSTM b) CNN
6	Write a program to develop : a) Auto encoders using MNIST Handwritten Digits. b) GAN for Generating MNIST Handwritten Digits.

REFERENCE BOOKS	
1	Navin Kumar Manaswi ,Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras , Apress,2018.
2	Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
3	Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition, 2017

8AID4-22: Robot Programming Lab

Credit: 1 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+2P **End Term Exam: 2 Hours**

SN	List of Experiments
1	An introduction to robot programming.
2	**Object Detection and Tracking Robot:** Create a robot with a camera that can detect and track objects in its field of view. Implement object detection algorithms and use them for tracking and interaction.
3	**Autonomous Maze Solving Robot:** Construct a robot that can autonomously navigate through a maze from the start to the finish. Implement maze-solving algorithms like A* or Dijkstra's algorithm.
4	**Reinforcement Learning for Robotic Arm Control:** Train a robotic arm to perform tasks using reinforcement learning. Implement algorithms like Deep Q-Networks (DQN) or Proximal Policy Optimization (PPO) to optimize arm movements.
5	**Human-Robot Interaction using Natural Language Processing (NLP):** Design a robot that can understand and respond to voice commands. Use NLP techniques to process and interpret human language to control the robot's actions.
6	**Robot-Assisted Healthcare and Patient Interaction**: Design a robot that can assist patients and healthcare professionals. Use AI to understand patient needs, provide information, and interact in a helpful and empathetic manner.
7	**Gesture Recognition and Control of Robotic Arm:** Build a robotic arm that responds to hand gestures. Train a machine learning model to recognize gestures, and use them to control the movements of the robotic arm.
8	**Obstacle Avoidance Robot with Ultrasonic Sensors:** Develop a robot capable of navigating an environment while avoiding obstacles using ultrasonic sensors. Implement basic obstacle avoidance algorithms and refine the robot's movements.

REFERENCE BOOKS	
1	Sebastian Thrun, Wolfram Burgard, and Dieter Fox, Probabilistic Robotics,MIT press
2	Francesco Amigoni and Matteo Matteucci, Artificial Intelligence for R obotics, Springer
3	Cameron Hughes and Tracey Hughes, Robot Programming: A Guide to Controlling Autonomous Robots, QUE Publishing