K.S.R.M. COLLEGE OF ENGINEERING

(AUTONOMOUS)
Pulivendula Road, Kadapa – 516005
Andhra Pradesh, India
Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
An ISO 14001:2004 & 9001: 2015 Certified Institution

Artificial Intelligence & Machine Learning

Curriculum

B.Tech. V Sem (R20UG)									
S.No.	**Course Code**	**Course Name**	**Category**	**Hours per Week**			**IM**	**EM**	**Credits**
				L	**T**	**P**	**40**	**60**	
1	2039501	Data Mining & Data Warehousing	PCC	3	0	0	40	60	03
2	2039502	Automata Theory & Compiler Design	PCC	3	0	0	40	60	03
3	2039503	Big Data Engineer (IBM)	PCC	3	0	0	40	60	03
4	2039504 2039505 2039506	**Professional Elective Course-I:** 1. Computer Networks 2. Image Processing 3. Web Technologies	PEC	3	0	0	40	60	03
5	20OE501 20OE507	**Open Elective Course -I:** 1. Data Structures 2. OOP through C++	OEC	3	0	0	40	60	03
6	2039507	Big Data Engineer Lab (IBM)	PCC LAB	0	0	3	40	60	1.5
7	2039508	Data Mining Lab	PCC LAB	0	0	3	40	60	1.5
8	2039509	**Skill Course-III:** Mobile App Development	SC	1	0	2	40	60	02
9	20MC510	**Mandatory Course:** Environmental Science	MC	2	0	0	40	---	00
10	2039510	Community Service Project	PROJ	0	0	3	100	---	1.5
		Total					**460**	**480**	**21.5**

B.TECH. V SEM (R20UG) SYLLABUS

Course Title	DATA MINING & DATA WAREHOUSING				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039501	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3 Hrs		

Course Objectives:

- To learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications.
- To develop skills of using data mining techniques for solving practical problems.
- To learn Data mining algorithms to build analytical applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the fundamentals of Data Mining and its Principles.
CO2	Understand different steps followed in Data mining and pre-processing for Datamining.
CO3	Apply appropriate data mining algorithms to find Frequent patterns, Associations, and Correlations.
CO4	Compare and evaluate data mining techniques classification, prediction.
CO5	Cluster the high dimensional data for better organization of the data and to detect the Outliers in the high dimensional data.

UNIT – I

Introduction: Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Major issues in Data Mining.

UNIT – II

Data Preprocessing:

Why Pre-process the Data? Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT – III

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining.

UNIT – IV

Classification: Basic Concepts, Decision Tree Induction, Baye's Classification Method, Rule-Based Classification.

Prediction: Basic concepts, Accuracy and Error measures, Evaluating the accuracy of a classifier or a predictor.

UNIT – V

Cluster Analysis: Cluster Analysis basic concepts, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods.

Outlier Detection - Outliers and Outlier Analysis, Outlier Detection Methods

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamberand Jian Pei, Morgan Kaufmann Publishers, Elsevier, Third Edition,2012.
2. Data Warehousing in the Real world, Sam Aanhory & Dennis Murray, Pearson Education, Asia.
3. Intelligent Data Mining, Da Raun. Guoquing Chen, Etienne E. Kerre. Geert Wets,Springer.
4. Data Mining & Data Warehousing: Principles and Practical Techniques, Parteek Bhatia, Cambridge.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press**.**
2. Insight into Data Mining, K.P. Soman, S. Diwakar, V. Ajay, PHI2008.
3. Data Mining: Introductory and Advanced Topics, Margaret H. Dunhan, Pearson.
4. Data Mining, Vikram Pudi, P. Radha Krishna, Oxford Higher Eduction.

Course Title	AUTOMATA THEORY & COMPILER DESIGN				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039502	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3 Hrs		

Course Objectives:

- To be able to construct finite state machines and the equivalent regular expressions and prove the equivalence of languages described by finite state machines and regular expressions.
- To be able to construct push down automata and the equivalent context free grammars, Turing machines and Post machines.
- To make the student to understand the process involved in compilation.
- Creating awareness among students on various types of parsers.
- Understand the syntax analysis, intermediate code generation, type checking, and the role of symbol table.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand of the notion of a regular set and its representation by DFA's, NFA's and regular expressions and the notion of a context-free language and its representation.
CO 2	Identify the applications of regular expressions and context-free grammars, Understand the concept of Push Down Automata and Solve to the problems using Turing machines.
CO 3	Understand and analyze the various phases of Compiler and Identify the tokens using lexical analysis, syntax analysis.
CO 4	Categorize and implement parsing techniques, understand syntax directed definition and develop type checking semantics usingsynthesized and inherited attributes.
CO 5	Understand the storage allocation and intermediate code representations, Summarize the code optimize techniques and demonstrate code generation technique and concepts.

UNIT – I

Fundamentals: Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, NFA to DFA conversion, Finite Automata with output-Moore and Mealy machines.

Regular Languages: Regular sets, regular expressions, constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions.

UNIT – II

Grammar Formalism: Regular grammars-right linear and left linear grammars, Context free grammar, derivation trees, sentential forms, Chomsky normal form, Grei back normal form, Push down automata, definition, model, acceptance of CFL, Turing Machine, definition, model, design of TM, Universal Turing Machine.

UNIT – III

Introduction to Compiling: Compilers, the phases of a Compiler.

Lexical Analysis: The role of the analyzer. Input buffering, specification of tokens, recognition of tokens.

Syntax Analysis: The role of the parser, writing a grammar, Top down parsing,

UNIT – IV

Parsing: Bottom-up parsing, LR parsers.

Type Checking: Type systems, Specification of type checker, Syntax Directed Definition

Intermediate code generation: Intermediate languages, implementation of three address code

UNIT – V

Code Generation: Issues in the Design of a code generator, Basic blocks and flow graphs, A simple code generator, Register allocation and assignment,

Code Optimization: Introduction, the principle source of optimization.

Text Books:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education.
2. Introduction to Theory of Computation - Sipser 2nd edition Thomson.
3. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers-Principles, Techniques and Tools, Pearson Education.

Reference Books:

1. Elements of Theory of Computation", Lewis H.P. & Papadimition C.H. Pearson /PHI.
2. Theory of Computer Science and Automata languages and computation -Mishra and Chandrashekaran,
3. K. Muneeswaran, Compiler Design, Oxforward university press.
4. M. Sreenivasulu, Compiler Design, Research India Publications.
5. K. V. N. Sunitha, Compiler Construction, Pearson Education.

Course Title	BIG DATA ENGINEER				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039503	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

IBM Skills Academy

Career path description: The Big Data Engineer career path prepares students to use the Big Data platform and methodologies in order to collect and analyze large amounts of data from different sources. This will require skills in Big Data architecture, such as Apache Hadoop, Ambari, Spark, Big SQL, HDFS, YARN, MapReduce, ZooKeeper, Knox, Sqoop, and HBase.

ibm.com/training

General information:

Delivery Method: 95% instructor led and 5% web-based

Version: 2018

Product: HDP Open Source and IBM Watson Studio

Audience: Undergraduate senior students from IT related academic programs i.e., computer science, software engineering, information systems and similar others.

Learning Objectives: After completing this course, you should be able to understand the following topics:

- Big Data and Data Analytics
- Hortonworks Data Platform (HDP) & Apache Ambari
- Hadoop and the Hadoop Distributed File System
- MapReduce and YARN
- Apache Spark
- Storing and Querying data
- ZooKeeper, Slider, and Knox
- Loading data with Sqoop
- Data Plane Service & Stream Computing
- Data Science essentials
- Drew Conway's Venn Diagram - and that of others
- The Scientific Process applied to Data Science
- The steps in running a Data Science project
- Languages used for Data Science (Python, R, Scala, Julia, ...)
- Survey of Data Science Notebooks
- Markdown language with notebooks
- Resources for Data Science, including GitHub
- Jupyter Notebook
- Essential packages: NumPy, SciPy, Pandas, Scikit-learn, NLTK, Beautiful Soup...
- Data visualizations: matplotlib, ..., Pixie Dust
- Using Jupyter "Magic" commands
- Using Big SQL to access HDFS data
- Creating Big SQL schemas and tables
- Querying Big SQL tables & Configuring Big SQL security
- Data federation with Big SQL
- IBM Watson Studio & Analyzing data with Watson Studio

Prerequisites Skills:

- Basic knowledge of Linux
- Basic SQL knowledge
- Working knowledge with big data and Hadoop technologies
- Have a basic understanding of notebook technologies for data science
- Students can attend free courses at www.bigdatauniversity.com to acquire the necessary requirements
- Exposure to the IBM Skills Academy Portal learning environment
- Exposure to the IBM Skills Academy Cloud hands-on labs platform

Duration: 32.7 Hours

Skill Level: Basic – Intermediate

Hardware Requirements:

Classroom (ILT) Setup Requirements:	
Processor	3 GHz or higher
GB RAM	20 GB
GB free disk space	80 GB
Network requirements	Yes
Other requirements	IBM ID

Notes: The following unit and exercise durations are estimates, and might not reflect every class experience. If the course is customized or abbreviated, the duration of unchanged units will probably increase.

Course Agenda

MODULE I – BIG DATA OVERVIEW			
	Course I – Introduction to the Big Data Ecosystem (Duration: 1.6 Hours)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – I: Introduction to Big data (Duration: 90 Minutes)	
		Overview	In this unit you will learn about Big Data and understand why it's important
		Learning objectives	After Completing this unit, you should be able to: • Understand what Big Data is • Develop an understanding of the complete open-source Hadoop ecosystem and its near-term future directions • Understand the major challenges of data • Understand how the growth of interconnected devices helps big data • List some real-life examples of Big Data • Learn the types of Big Data & Student some Big Data use cases
MODULE II – Prerequisites			
	This course does not have any prerequisites		
MODULE III – Big Data Engineer			
	Course I – Introduction to the Big Data Ecosystem (Duration: 19.5 Hours)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – I: Introduction to Big data (Duration: 30 Minutes)	
		Overview	In this unit you will learn about Big Data and understand why it's important
		Learning objectives	After Completing this unit, you should be able to: • Develop an understanding of the complete open-source Hadoop ecosystem and its near-term future directions. • Be able to compare and evaluate the major Hadoop distributions and their ecosystemcomponents, both their strengths and their limitations.

			• Gain hands-on experience with key components of various big data ecosystem components and their roles in building a complete big data solution to common business problems. • Learning the tools that will enable you to continue your big data education after the course.
		Unit – 2: Introduction to Hortonworks Data Platform (HDP) - (Duration: 30 Minutes)	
		Overview	In this unit you will learn about the Hortonworks Data Platform (HDP).
		Learning objectives	After Completing this unit, you should be able to: • Describe the functions and features of HDP • List the IBM value-add components • Explain what IBM Watson Studio is • Give a brief description of the purpose of each of the value - add components
		Lab – 1: Exploration of the lab environment (Duration: 01 Hour)	
		Overview	In this lab, you will explore the lab environment. You will access your lab environment and launch Apache Ambari. You will startup a variety of services by using the Ambari GUI. You willalso explore some of the directory structure on the Linux system that you will be using.
		Learning objectives	After Completing this unit, you should be able to: • Explore the lab environment • Launch Apache Ambari • Start a variety of services using Apache GUI • Explore some of the directory structure on the Linux system
		Unit – 3: Apache Ambari (Duration: 30 Minutes)	
		Overview	In this section you will learn about Ambari, which is one of the operations tools that come withHDP
		Learning objectives	After Completing this unit, you should be able to: • Understand the purpose of Apache Ambari in the HDP stack • Understand the overall architecture of Ambari, and Ambari's relation to other services andcomponents of a Hadoop cluster • List the functions of the main components of Ambari • Explain how to start and stop services from Ambari Web Console
		Lab – 1: Managing Hadoop clusters with Apache Ambari (Duration: 01 Hour)	
		Overview	In this lab you will explore the Apache Ambari web console and perform basic starting andstopping of services, giving you experience in using Apache Ambari to manage your Hadoopcluster
		Learning objectives	After Completing this unit, you should be able to: • Manage Hadoop clusters with Apache Ambari ❖ Start the Apache Ambari web console and perform basic start/stop services ❖ Explore other aspects of the Ambari web server
		Unit – 4: Hadoop and HDFS (Duration: 01 Hour)	
		Overview	This unit will explain the underlying technologies that are important to solving the big data challenge
		Learning objectives	After Completing this unit, you should be able to: • Understand the basic need for a big data strategy in terms of parallel reading of large datafiles and internode network speed in a cluster • Describe the nature of the Hadoop Distributed File System (HDFS) • Explain the function of the Name Node and Data Nodes in an Hadoop cluster • Explain how files are stored and blocks ("splits") are replicated

		Lab – 1: File access and basic commands with HDFS (Duration: 01 Hour)	
		Overview	This lab is intended to provide you with experience in using the Hadoop Distributed File System(HDFS). The basic HDFS file system commands learned here will be used throughout the remainder of the course. You will also be moving some data into HDFS that will be used in later units of this course. The files that you will need are stored in the Linux directory / home / lab files
		Learning objectives	After Completing this unit, you should be able to: • File access and basic commands with HDFS
		Unit – 5: Map Reduce and YARN (Duration: 02 Hours)	
		Overview	In this unit you will learn about MapReduce and YARN
		Learning objectives	After Completing this unit, you should be able to: • Describe the MapReduce model v1 • List the limitations of Hadoop 1 and MapReduce 1 • Review the Java code required to handle the Mapper class, the • Reducer class, and the program driver needed to access MapReduce • Describe the YARN model • Compare Hadoop 2/YARN with Hadoop 1
		Lab – 1: Running MapReduce and YARN jobs (Duration: 01 Hour)	
		Overview	In this lab, you will run Java programs using Hadoop v2, YARN, and related technologies
		Learning objectives	After Completing this unit, you should be able to: • Run MapReduce and YARN jobs
		Lab – 2: Creating and coding a simple Map Reduce job (Duration: 01 Hour)	
		Overview	In this lab, you will compile and run a more complete version of Word Count that has beenwritten specifically for Map Reduce2
		Learning objectives	After Completing this unit, you should be able to: • Create and code a simple MapReduce job
		Unit – 6: Apache Spark (Duration: 02 Hours)	
		Overview	In this unit you will learn about Apache Spark.
		Learning objectives	After Completing this unit, you should be able to: • Understand the nature and purpose of Apache Spark in the Hadoop ecosystem • List and describe the architecture and components of the Spark unified stack • Describe the role of a Resilient Distributed Dataset (RDD) • Understand the principles of Spark programming • List and describe the Spark libraries • Launch and use Spark's Scala and Python shells
		Lab – 1: Working with a Spark RDD with Scala (Duration: 01 Hour)	
		Overview	In this lab, you will learn to use some of the fundamental aspects of running Spark in the HDP environment
		Learning objectives	After Completing this unit, you should be able to: • Work with Spark RDD with Scala
		Unit – 7: Storing and querying data (Duration: 02 Hours)	
		Overview	In this unit you will learn about storing and querying data
		Learning objectives	After Completing this unit, you should be able to: • List the characteristics of representative data file formats, including flat/text files, CSV,XML, JSON, and YAML • List the characteristics of the four types of NoSQL datastores • Describe and compare the open – source programming languages, Pig and Hive

			• Describe the storage used by HBase in some detail • List the characteristics of programming languages typically used by Data Scientists: R and Python
		Lab – 1: Using Hive to access Hadoop/HBase data (Duration: 30 Minutes)	
		Overview	In this lab, you will use Hive to access Hadoop/HBase data
		Learning objectives	After Completing this lab, you should be able to: • Use Hive to access Hadoop/HBase data
		Unit – 8: ZooKeeper, Slider, and Knox (Duration: 01 Hour)	
		Overview	In this unit you will learn about ZooKeeper, Slider and Knox
		Learning objectives	After Completing this unit, you should be able to: • Understand the challenges posed by distributed applications and how ZooKeeper isdesigned to handle them • Explain the role of ZooKeeper within the Apache Hadoop infrastructure and the realm ofBig Data management • Explore generic use cases and some real-world scenarios for ZooKeeper • Define the ZooKeeper services that are used to manage distributed systems • Explore and use the ZooKeeper CLI to interact with ZooKeeper services • Understand how Apache Slider works in conjunction with YARN to deploy distributedapplications and to monitor them • Explain how Apache Knox provides peripheral security services to an Hadoop cluster
		Lab – 1: Explore ZooKeeper (Duration: 30 Minutes)	
		Overview	In this lab, you will connect to ZooKeeper and explore the ZooKeeper files
		Learning objectives	After Completing this lab, you should be able to: • Connect to ZooKeeper and explore the ZooKeeper files
		Unit – 9: Loading data with Sqoop (Duration: 30 Minutes)	
		Overview	In this unit you will learn how to load data with Sqoop
		Learning objectives	After Completing this unit, you should be able to: • List some of the load scenarios that are applicable to Hadoop • Understand how to load data at rest • Understand how to load data in motion • Understand how to load data from common sources such as a data warehouse, relationaldatabase, web server, or database logs • Explain what Sqoop is and how it works • Describe how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems • Brief introduction to what Flume is and how it works
		Lab – 1: Moving data into HDFS with Sqoop (Duration: 30 Minutes)	
		Overview	In this lab, you will learn how to move data into an HDFS cluster from a relational database
		Learning objectives	After Completing this lab, you should be able to: • Move data into HDFS with Sqoop
		Unit – 10: Security and Governance (Duration: 01 Hour)	
		Overview	In this unit you will learn about the need of data governance and the role of data security in it

		Learning objectives	After Completing this unit, you should be able to: • Explain the need for data governance and the role of data security in this governance • List the Five Pillars of security and how they are implemented with HDP • Discuss the history of security with Hadoop • Identify the need for and the methods used to secure Personal & Sensitive Information • Describe the function of the Hortonworks Data Plane Service (DPS)
		Unit – 11: Stream Computing (Duration: 01 Hour)	
		Overview	In this unit you will learn about stream computing
		Learning objectives	After Completing this unit, you should be able to: • Define streaming data • Describe IBM as a pioneer in streaming data - with System S □IBM Streams • Explain streaming data - concepts & terminology • Compare and contrast batch data vs streaming data • List and explain streaming components & Streaming Data Engines (SDEs)
	Course II – Introduction to Data Science (Duration: 1.75 Hours)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – 1: Data Science and Data Science Notebooks (Duration: 45 Minutes)	
		Overview	In this unit, you will learn about data science and data science notebooks
		Learning objectives	After Completing this unit, you should be able to: • Have a better understanding of methodology "scientific approach" methods used & skillspracticed by Data Scientists • Recognize the iterative nature of a data science project • Outline the benefits of using Data Science Notebooks • Describe the mechanisms and tools used with Data Science Notebooks • Compare and contrast the major Notebooks used by Data Scientists
		Unit – 2: Data Science with Open - Source Tools (Duration: 30 Minutes)	
		Overview	In this unit, we will concentrate on the Jupyter Notebook and Python
		Learning objectives	After Completing this unit, you should be able to: • Getting started with Jupyter Notebook • Data and notebooks in Jupyter • How notebooks help data scientists • Essential packages: NumPy, SciPy, Pandas, Scikit-learn, NLTK, Beautiful Soup, … • Data visualizations: matplotlib, …, Pixie Dust • Using Jupyter "Magic" commands
		Lab – 1: Introduction to Jupyter Notebooks (Duration: 30 Minutes)	
		Overview	In this lab you will be introduced to Jupyter Notebooks
		Learning objectives	After Completing this experiment, you should be able to: • Start Jupyter - it will open in a web browser • Import the lab file (all Jupyter files have a .ipynb suffix) into your default workspace o This is now a copy of the provided lab file and you can do anything with it o If you mess it up, you can re-import again later

			• Explore the component panels - some are markdown, some are code, some are results ofrunning the code (output data, visualizations, …) • Learn how to run single panels - and then the whole script o You may need to adjust the provided script to locate the data files that accompany the Jupyter. ipynb file o Add some additional panels, as described in the lab script
	Course III – Big SQL (Duration: 7.25 Hours)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – 1: Using Big SQL to access data residing in the HDFS (Duration: 40 Minutes)	
		Overview	In this unit, you will learn about Big SQL, and how to use it to access data residing in the HDFS
		Learning objectives	After Completing this unit, you should be able to: • Overview of Big SQL • Understand how Big SQL fits in the Hadoop architecture • Start and stop Big SQL using Ambari and command line • Connect to Big SQL using command line • Connect to Big SQL using IBM Data Server Manager
		Lab – 1: Connecting to the IBM Big SQL Server (Duration: 30 Minutes)	
		Overview	In this lab you will connect to the Big SQL Server using multiple techniques. You will first explore the lab environment. You will then learn how to set up JSqsh and use it to connect to the Big SQL server. You will also explore the Big SQL service using the Data Server Manager (DSM) graphical web interface
		Learning objectives	After Completing this exercise, you should be able to: • Configure images • Start Hadoop components • Start up the Big SQL and DSM services • Connect to Big SQL using JSqsh • Execute basic Big SQL statements • Explore Big SQL through Ambari using DSM
		Unit – 2: Creating Big SQL schemas and tables (Duration: 55 Minutes)	
		Overview	In this unit, you will learn how to create Big SQL schemas and tables
		Learning objectives	After Completing this unit, you should be able to: • Describe and create Big SQL schemas and tables • Describe and list the Big SQL data types • Work with various Big SQL DDLs • Load data into Big SQL tables using best practices
		Lab – 1: Creating and managing Big SQL schemas and tables (Duration: 35 Minutes)	
		Overview	In this lab you will start off by creating and dropping a simple Big SQL table. You then will createmultiple Big SQL tables using a variety of data types and load the tables with data. You will also work with views, external tables, and other methods of creating Big SQL tables
		Learning objectives	After Completing this exercise, you should be able to: • Create and drop simple Big SQL table • Create sample tables • Move data into HDFS • Load data into Big SQL tables • Create and work with views • Create external tables

		Unit – 3: File formats and querying Big SQL tables (Duration: 01 Hour)	
		Overview	In this unit, you will learn about file formats and querying Big SQL tables
		Learning objectives	After Completing this unit, you should be able to: • Describe Big SQL supported file formats • Query Big SQL tables using various DMLs
		Lab – 1: Querying Big SQL tables (Duration: 30 Minutes)	
		Overview	In this lab you will experiment with some more advanced SQL queries. You will then explore Big SQL's ARRAY type. You will also create a user-defined function (UDF) and write queries that callthe UDF. Finally, you will store data in an alternate file format (Parquet).
		Learning objectives	After Completing this exercise, you should be able to: • Connect to Big SQL • Query data with Big SQL • Work with the ARRAY type • Work with Big SQL functions • Store data in an alternate file format (Parquet)
		Unit – 4: Configuring Big SQL security (Duration: 01 Hour)	
		Overview	In this unit, you will learn about how to configure Big SQL security
		Learning objectives	After Completing this unit, you should be able to: • Configure authentication for Big SQL • Manage security with Apache Ranger • Enable SSL encryption • Configure authorization of Big SQL objects • Configure impersonation in Big SQL
		Lab – 1: Configuring Big SQL Security (Duration: 30 Minutes)	
		Overview	In this lab you will work with Big SQL authorization techniques
		Learning objectives	After Completing this lab, you should be able to: • Use column masking and row - based access control to restrict access to your data
		Lab – 2: Configuring impersonation in Big SQL (Duration: 30 Minutes)	
		Overview	In this lab you will enable and configure impersonation with Big SQL
		Learning objectives	After Completing this lab, you should be able to: • Configure impersonation in Big SQL
		Unit – 5: Data federation with Big SQL (Duration: 45 Minutes)	
		Overview	In this unit, you will learn data federation with Big SQL
		Learning objectives	After Completing this unit, you should be able to: • Understand the concept of Big SQL federation • List the supported data sources • Set up and configure a federation server to use different data sources
		Lab – 1: Using Fluid Query with Big SQL (Duration: 15 Minutes)	
		Overview	In this lab you will configure Fluid Query with Big SQL
		Learning objectives	After Completing this lab, you should be able to: • Configure Fluid Query with Big SQL
	Course IV – IBM Watson Studio (Duration: 2.60 Hours)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – 1: Introduction to IBM Watson Studio (Duration: 30 Minutes)	
		Overview	In this unit, you will learn about Watson Studio
		Learning objectives	After Completing this unit, you should be able to: • What is Watson Studio? • Setting up a project & Working with collaborators • Managing data assets

		Lab – 1: Getting started with Watson Studio (Duration: 01 Hour)	
		Overview	In this lab, you will create and manage a project, add collaborators, and load a data set to theobject store
		Learning objectives	After Completing this lab, you should be able to: • Sign up for a Watson Studio account • Create a new project • Manage a project • Add collaborators • Load data • Manage the object storage
		Unit – 2: Analyzing data with Watson Studio (Duration: 30 Minutes)	
		Overview	In this unit, you will learn how to analyze data with Watson Studio.
		Learning objectives	After Completing this unit, you should be able to: • Overview of Jupyter notebooks • Creating notebooks • Coding and running notebooks • Sharing and publishing notebooks
		Lab – 1: Analyzing data with Watson Studio (Duration: 30 Minutes)	
		Overview	In this lab, you will run through a sample notebook in Watson Studio and use Pixie Dust for data visualization
		Learning objectives	After Completing this lab, you should be able to: • Create a notebook • Use notebooks • Work with external data

Course Title	COMPUTER NETWORKS (Professional Elective Course-I)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039504	PEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3 Hrs		

Course Objectives:

- Study the evolution of computer networks and future direction.
- Study the concepts of computer networks from layered.
- Perspective study the issues open for research in computer networks.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the terminology and concepts of the OSI reference model and TCP-IP.
CO2	Describe the functions of Data link layer and its protocols.
CO3	Classifying the different routing algorithms and IP addressing with network layer
CO4	Understand connection establishment and services provides by TCP and UDP.
CO5	Explain the working of DNS and World Wide Web.

UNIT - I

Introduction: Uses of Computer Networks, Network Hardware, Reference Models: OSI, TCP/IP,Comparison of OSI & TCP/IP reference models.

Introduction to physical layer: Data and Signals, Transmission impairment, Data rate limits, Performance.

Transmission media: Introduction, Guided Media, Unguided Media.

Switching: Introduction, Circuit Switched Networks, Packet Switching.

UNIT - II

The Data Link Layer: Data Link Layer design issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.

The Medium Access Control sublayer : Multiple Access protocols, Ethernet, Data Link LayerSwitching.

UNIT - III

The Network Layer: Network layer design issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, Congestion control algorithms, Quality of service, IP Addresses, IPv4, IPv6, Tunneling, Fragmentation.

UNIT - IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, the internet transport protocols: UDP, TCP: Introduction to TCP, Service Model, Protocol, Segment Header, Connection Establishment, Connection Release.

UNIT - V

The Application layer: Domain Name System (DNS), World Wide Web (WWW), E- mail.

Text Books:

1. "Computer Networks", Andrew S. Tanenbaum, David J.Wetherall, Pearson, 5th edition, 2010.
2. "Data communications and networking", Behrouz A. Forouzan, TMH, 5th edition, 2012.
3. "Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E.Comer, 5th edition, PHI
4. "Computer Networks", 5E, Peterson, Davie, Elsevier.

Reference Books:

1. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRCPublications.
2. "Computer Networks and Internets with Internet Applications", Comer.
3. Computer Networks, A Top-Down Approach, James F. Kurose, Keith W. Ross, 3rd Edition,Pearson.
4. Computer Networks, A Top-Down Approach, Behrouz A. Forouzan, Firoz Mosharraf, Special Indian Edition, McGraw Hill.

Course Title	IMAGE PROCESSING (Professional Elective Course – I)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039505	PEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Acquire the basic knowledge on fundamentals of digital images.
- Learn about image enhancement in spatial domain, image filtering and color image processing.
- Understand various image segmentation and image coding schemes.
- Learn image transform to analyze and modify image.
- Learn concepts of degradation function and restoration techniques.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the concepts of image processing system and various operations that can perform on digital images.
CO2	Understand the image enhancement in spatial and frequency domain.
CO3	Understand various image restoration techniques.
CO4	Understand various image compression and segmentation techniques.
CO5	Understand the various mathematical transforms, color image concepts and processing.

UNIT – I

Basic Concepts Definition, Applications of Digital Image Processing, Fundamental Steps, Components of Image Processing System, Human Visual System, Simple Image Formation Model, Image Sampling and Quantization, Spatial and Gray Level Resolution, Image Interpolation, Some Basic Relationships Between Pixels, Linear And Non Linear Operations.

UNIT – II

Spatial Domain: Basic Gray Level Transformations, Histogram Processing, Enhancement Using Logical And Arithmetic Operations, Image Subtraction, Image Averaging, Basic of Spatial Filtering, Smoothing And Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Frequency Domain: Introduction to Fourier Transforms, Basics of Filtering in Frequency Domain, Fundamental Steps in Filtering in Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.

UNIT – III

Image Restoration Model of Image Degradation/Restoration Model, Noise Models, Restoration In Presence of Noise Only-Spatial Filtering, Adaptive Filters, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Derivations, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.

UNIT-IV

Image Compression: File format (bmp, tiff, pcx, gif, jpeg.), Compression fundamentals, Image Compression Models, Error Free Compression: VLC, Arithmetic Coding, LZW coding, Bit plane Coding, Lossless Predictive Coding, Lossy Compression: Lossy Predictive Coding, Block Transform coding

Image Segmentation: Fundamentals, Detection of Discontinuities: Point, Line, Edge detection, Edge Linking and Boundary Detection: Local Processing, Global Processing via Hough Transform.

UNIT – V

Image Transforms: Introduction One- and Two-Dimensional Discrete Fourier Transform (DFT), Properties of DFT, Properties of Discrete cosine and sine transforms, Properties of Slant, KL transforms.

Color Image Processing: Color fundamentals, Color models: RGB, CMY and CMYK, HSI, Converting colors, RGB to HIS, HIS to RGB manipulating HIS component images, Pseudo color Image Processing, Full Color Image Processing.

Text Books:

1. Rafael Gonzalez & Richard Woods, ―Digital Image Processing‖, 3rd Edition. Pearson publications, 2012
2. Anil K. Jain, ―Fundamental of Digital Image Processing‖, PHI publication, 2013.
3. S. Jayaraman, S. Esakkirajan & T. Veera Kumar, ―Digital Image Processing‖, Mc. Graw Hill, 2011.

Reference Books:

1. Pratt, ―Digital Image Processing‖, 2nd Edition, Wiley Publication, 1991.
2. S. Sridhar, ―Digital Image Processing‖, Oxford University Press, 2011.

Web References:

1. https://nptel.ac.in/courses/117105079/
2. https://nptel.ac.in/courses/117104069/
3. https://nptel.ac.in/courses/106105032/

Course Title	WEB TECHNOLOGIES (Professional Elective Course – I)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039506	PEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Familiarize the tags of HTML.
- Write backend code in PHP language and Writing optimized front end code HTML and JavaScript.
- Understand, create and debug database related queries and Create test code to validate the applications against client requirement.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Enumerate the Basic Concepts of Markup Languages.
CO2	Develop web Applications using Scripting Languages & Frameworks.
CO3	Make use of Express JS frameworks.
CO4	Develop server side programs using PHP.
CO5	Accessing database through PHP.

UNIT - I

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML.

CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats,

UNIT - II

JavaScript: Introduction to JavaScript, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions,

UNIT - III

Fundamentals of Angular JS and NODE JS Angular Java Script- Introduction to Angular JS. **Expressions:** ARRAY, Objects, Strings, Angular JS Form Validation & Form Submission.

UNIT - IV

PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. PHP Advanced Concepts: Using Cookies, Using HTTP Headers, Using Sessions, Authenticating users.

UNIT - V

Database connectivity – Basic Database Concepts, Connecting to a MYSQL database, JSP, PHP, Practice of SQL Queries. Introduction to Mongo DB and JQuery.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
3. Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
4. Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly,2011.
5. Beginning PHP and MySQL, 5th Edition, Jason Gilmore, A press Publications (Dreamtech.)

Reference Books:

1. Ruby on Rails Up and Running, Lightning fast Web development, 1st Edition, Bruce Tate, Curt Hibbs, Oreilly, 2006.
2. Programming Perl, 4th Edition, Tom Christiansen, Jonathan Orwant, O'Reilly, 2012.
3. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.

Course Title	DATA STRUCTURES (Open Elective Course – I)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
20OE501	OEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To develop skills and analyze linear and nonlinear data structures.
- To understand basic concepts about linked lists, stacks, queues.
- To study algorithms as they apply to trees and graphs.
- To study in detail about sorting.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the variety of abstract data types and data structures.
CO2	Analyze data structures such as linked list, Stacks and Queues.
CO3	Apply and analyze tree traversal algorithms and graph traversal algorithms.
CO4	Organize data in order using various sorting algorithms.

UNIT - I

Introduction: Data structures, Primitive & Non Primitive data structures, Linear & Non Linear data structures, **Linear Lists:** Definition, **Arrays:** Definition, **Linked Lists:** Single Linked List-Definition, Insertion and Deletion operations**,** Doubly Linked List- Definition,Insertion and Deletion operations. **Stacks:** Definition, Array & Linked representations, Operations, Applications.

UNIT – II

Queues: Definition, Array & Linked representations, Operations, Circular Queues &Dequeues.
Trees: Basic terminology, **Binary Trees** - Definition, Properties, Representation, Completeand Full Binary Tree, **Tree Traversal Algorithm:** In order, Preorder and Post order.

UNIT – III

Binary Search Tree (BST): Definition, Operations& Implementations, Indexed BST.
Balanced Search Trees: AVL trees, Red-Black trees & Splay trees.

UNIT - IV

Graphs: Terminology, Representations, **Graph Traversal:** Depth First Search (DFS),Breadth First Search (BFS), Applications of graphs.

UNIT - V

Sorting: Selection, Insertion, Bubble, Heap, Quick Sort, Merge Sort.
Searching: Linear and Binary search.
Hashing: Introduction, Hash Table representation, Hash Functions.

Text Books:

1. An Introduction to Data Structures with applications, Jean Paul Trembley and PaulG.Sorenson, McGraw Hill.

2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed,Universitiespress.
3. Data Structures using C++, Varsha H.Patil, Oxford University Press.
4. Data Structures, Seymour Lipschutz, Schaum's Outlines, McGraw Hill.
5. Data Structures and Algorithms, G.A.V.Pai, Tata McGraw Hill.

Reference Books:

1. Data Structures, Algorithms and Applications in C++, AnandaRao Akepogu and Radhika Raju Palagiri, Pearson Education.
2. Data Structures and Algorithms in C++, S.Sahni, University Press (India) Private Limited,Second Edition.
3. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

Web links:

1. **https://nptel.ac.in/courses/106102064**
2. **https://nptel.ac.in/courses/106103069**

Course Title	OOP THROUGH C++ (Open Elective Course – I)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	**Category**	**Hours / Week**		**Credits**	**Maximum Marks**		
20OE507	**PJ**	**L**	**T**	**P**	**C**	**ContinuousInternal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					**End Exam Duration: 3Hrs**		

Course Objectives:

- To make the students understand the features of object-oriented design and familiarize them with virtual functions, templates and exception handling.
- To enable the students solve various engineering problems in C++ programming language.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the fundamentals of C++
CO 2	Explain the concept of Tokens and Control Structures.
CO 3	Illustrate the concept of Classes and Objects.
CO 4	Demonstrate the concept of Operator overloading and Inheritance.
CO 5	Understand the concept of Pointers, Virtual functions and Polymorphism

UNIT – I

Principles of Object-Oriented Programming: Object-Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP. **Beginning with C++:** Comments, Output Operator, The iostream File, Variables, Input Operator, Cascading of I/O Operators, Structure of C++ program.

UNIT – II

Tokens, Expressions and Control Structures: Tokens, Keywords, Identifiers and Constants, Basic Data Types, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Memory management operators, Manipulators, Control Structures,

Functions in C++: Function Prototyping, Call by reference, Return by reference, Inline Functions, Function Overloading.

UNIT – III

Classes and Objects: Specifying a Class, Defining Member Functions, Memory allocation for objects, Static data members, Static member functions, Arrays of objects, Friendly functions, **Constructors and Destructors:** Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Copy constructor, Dynamic constructor, Destructors.

UNIT – IV

Operator Overloading: Defining operator overloading, Overloading Unary operators, Overloading Binary operators, Overloading Binary operators using Friends.

Inheritance: Introduction, Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual base classes, Abstract classes.

UNIT – V

Pointers, Virtual Functions and Polymorphism: this Pointer, Virtual Functions, Pure virtual functions.

Managing Console I/O Operations: Unformatted I/O operations, Formatted console I/O operations.

Templates: Class Templates, Function Templates, Overloading Template functions, Member function Templates.

Exception Handling: Basics of Exception handling, Exception handling mechanism.

Text Books:

1. The Complete Reference C++, Herbert Schildt, TMH 4th Edition.
2. Learning - Computer Science :A Structured Approach Using C++,2nd Ed., Forouzan, Thomson.
3. Object Oriented Programming With C++, E. Balagurusamy, TMH 6th edition.

Reference Books:

1. Object oriented programming with ANSI and TURBO C++, Ashok N Kamathane, Pearson education.
2. Object oriented programming with C++, Saurav Sahay, Oxford.
3. Learning C++ Programming :From Problem Analysis To Program Design, Malik,Thomson

Course Title	DATA MINING LAB				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039508	PCC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- The different data mining models and techniques will be discussed in this course.
- Data mining and data warehousing applications in bioinformatics will also be explored.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the data mining process and important issues around data cleaning, pre - processing and integration.
CO 2	Understand the principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction.

Credit Risk Assessment

Description: The business of banks is making loans. Assessing the credit worthiness of an applicant is of crucial importance. You have to develop a system to help a loan officer decide whether the credit of a customer is good, or bad. A bank's business rules regarding loans must consider two opposing factors. On the one hand, a bank wants to make as many loans as possible. Interest onthese loans is the banks profit source. On the other hand, a bank cannot afford to make too many badloans. Too many bad loans could lead to the collapse of the bank. The bank's loan policy must involve a compromise: not too strict, and not too lenient.

To do the assignment, you first and foremost need some knowledge about the world ofcredit. You can acquire such knowledge in a number of ways.

1. Knowledge Engineering. Find a loan officer who is willing to talk. Interview her and try to represent her knowledge in the form of production rules.
2. Books. Find some training manuals for loan officers or perhaps a suitable text book on finance. Translate this knowledge from text form to production rule form.
3. Common sense. Imagine yourself as a loan officer and make up reasonable rules whichcan be used to judge the credit worthiness of a loan applicant.
4. Case histories. Find records of actual cases where competent loan officers correctly judged when, and when not to, approve a loan application.

The German Credit Data:

Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. credit dataset (original) Excel spreadsheet version of the German credit data (Down load from web).

In spite of the fact that the data is German, you should probably make use of it for thisassignment. (Unless you really can consult a real loan officer!)

A few notes on the German dataset

- DM stands for Deutsche Mark, the cents Canadian (but looks and acts like a quarter).
- Owns telephone. German phone rat so fewer people own telephones.
- Foreign here are worker millions of these. Tin Germany (many from Turrkey). It is very hard toget German citizenship if you were not born of German parents.
- There are 20 attributes used in the classify the applicant into one of two categories, good orbad.

Subtasks: (Turn in your answers to the following tasks)

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. What attributes do you think might be crucial in making the credit assessment? Come up withsome simple rules in plain English using your selected attributes.
3. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
4. Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy?
5. Is testing on the training set as you did above a good idea? Why or why not?
6. One approach for solving the problem encountered in the previous question is using cross validation? Describe what is cross-validation briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why? (10 marks)

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han, MichelineKamberand Jian Pei,Morgan Kaufmann Publishers, Elsevier, Third Edition,2012.
2. Data Warehousing in the Real world, Sam Aanhory& Dennis Murray, Pearson Education, Asia.
3. Intelligent Data Mining, Da Raun.Guoquing Chen, Etienne E. Kerre. Geert Wets,Springer.
4. Data Mining & Data Warehousing: Principles and Practical Techniques, Parteek Bhatia, Cambridge.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press.
2. Insight into Data Mining, K.P.Soman, S.Diwakar , V.Ajay, PHI2008.
3. Data Mining: Introductory and Advanced Topics, Margaret H. Dunhan, Pearson.
4. Data Mining, Vikram Pudi, P. Radha Krishna, Oxford Higher Eduction.

Course Title	MOBILE APP DEVELOPMENT (Skill Course – III)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
2039509	SC	1	0	2	2	40	60	100
					End Exam Duration: 3 Hrs			

Course Objectives:

- To understand fundamentals of android operating systems.
- Illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop applications using services and publishing android applications.
CO 2	To demonstrate their skills of using Android software development tools.

LIST OF EXPERIMENTS

1. Setting up the Development Environment
   - **a.** Installation of JDK and Setting path
   - **b.** Downloading and Installing Android Studio
2. Creating "Hello World" Application and viewing the output through emulator.
3. Creating the Application by using Activity class
   - **i)** On Create () **ii)** on Start () **iii)** on Resume () **iv)** on Pause ()
   - **v)** On Stop () **vi)** on Destroy () **vii)** on Restart ()
4. Create the Application using the Edit Text control.
5. Create the Application Choosing options.
   - **i)** Check Box **ii)** Radio Button **iii)** Spinner
6. Create the applications using different layouts.
   - **i)** Linear Layout **ii)** Relative Layout **iii)** Absolute Layout **iv)** TableLayout
7. Create the application for doing arithmetic operations. (Calculator)
8. Create the application to play the audio and video clips.
9. Create the application by using menus and action bar.

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. T1. Lauren Darcey and Shane Conder, "Android Wireless ApplicationDevelopment", Pearson Education, 2nd ed. (2011)
3. Android application Development for Java Programmers, James C Sheusi, CengageLearning
4. Android In Action by W.Frank Ableson, Robi Sen, Chris King, C. EnriqueOrtiz.,Dreamtech.

Reference Books:

1. Beginning Android 4 Application Development, by Wei-Meng Lee , Wiley India.
2. Android Programming for Beginners, John Horton, 2nd Edition, Packt.
3. Android App Development for Dummies, Michael Burton, 3rd Edition, Wiley.

Course Title	ENVIRONMENTAL SCIENCE (Mandatory Course)				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
20MC510	MC	3	--	--	0	40	--	--
Mid Exam Duration: 2Hrs								

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Explain** multidisciplinary nature of environmental studies and various Renewable and Nonrenewable resources.
CO 2	**Understand** the Energy flow, bio-geo chemical cycles and ecological pyramids
CO 3	**Illustrate** various causes of pollution and related preventive measures.
CO 4	**Summarize** Solid waste management, Social issues related to environment and their protection acts.
CO 5	**Evaluate** Causes of population explosion, value education and welfare programmes.

UNIT – I

Multidisciplinary Nature of Environmental Studies: –Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems

Forest resources: deforestation, case studies – Mining, dams and other effects on forest and tribal people

Water resources: Use and over utilization of surface and ground water conflicts over water.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Renewable &Non-Renewable.

Learning Outcomes

- **Explain** the importance of public awareness
- **List** the various natural resources

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food web- Ecological succession and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.

b. Desert ecosystem

c. Aquatic ecosystems (lakes, rivers and oceans)

Biodiversity And Its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes:

- **Understand** different types of eco systems and their characteristics.
- **Classify** types of biodiversity and its conservation methods.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes:

- **Identify** various sources of pollution and solid waste along with preventive measures
- **Explain** the different types of disasters and their managerial measures.

UNIT – IV

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

Learning Outcomes:

- **Outline** the social issues related to environment and their protection acts.(L2)
- **To know** about wild life protection , forest conservation act and conservation of natural resources (L2)

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes:

- **Illustrate** about the population explosion and family welfare programmes.(L2)
- **To identify** the natural assets and related case studies.(L3)

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses, Erach Bharucha for University Grants Commission, Universities Press.
2. Fundamental Concepts of Environmental Chemistry- Sodhi G S – Oxford University
3. Environmental Chemistry- Anil Kumar De-Willey Publications
4. Environment Impact Assessment- Larry W. Canter- Mc Graw Hill publications

Reference Books:

1. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
2. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.
3. Environmental Science, A Global Concerns, William P. Cunningham, Mary Ann Cunningham, Mc Graw Hill publications.
4. Environmental Science & Engineering, Glynn Henry J ,Heinke Gary w, Pearson publications

Course Title	COMMUNITY SERVICE PROJECT				B.Tech. V Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039510	PROJ	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		-	-	3	1.5	100	-	100
Internal Evaluation								

Course Objectives:

- The objective of the project is to enable the student to take up investigative study in rural areas / Community in the field of Computer Science and Engineering.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand core concepts and research findings relative to human development, socialization, group dynamics and life course processes.
CO 2	Identify and transfer existing ideas into new contexts and applications.
CO 3	Apply and transfer academic knowledge into the real-world.
CO 4	Design a component or a product applying all the relevant standards and with realistic constraints.

The following are the rules and regulation for **Community Service Project Projects:**

1. The student has to spend 50 to 60 Hrs in the semester on any Community Service Project and submit a report for evaluation.
2. The project is evaluated for 100 marks in the semester by a committee consisting of head of thedepartment, project mentor and one senior faculty member of the department.
3. A student shall acquire 2 credits assigned, when he/she secures 50% or more marks from the totalof 100 marks.
4. In case, if a student fails, he/she shall resubmit the report.
5. There is no external evaluation for the Community Service Project.

B.Tech. VI Sem (R20UG)									
S.No.	**Course Code**	**Course Name**	**Category**	**Hours per Week**			**IM**	**EM**	**Credits**
				L	**T**	**P**	**40**	**60**	
1	2039601	Deep Learning	PCC	3	0	0	40	60	03
2	2039602	Software Engineering	PCC	3	0	0	40	60	03
3	2039603	Predictive Analytics Modeler (IBM)	PCC	3	0	0	40	60	03
4	2039604 2039605 2039606	**Professional Elective Course – II:** 1. Cryptography and Network Security 2. Cloud Computing 3. Computational Intelligence	PEC	3	0	0	40	60	03
5	20OE506 20OE502	**Open Elective Course – II:** 1. Principles of Operating Systems 2. Data Base Management Systems	OEC	3	0	0	40	60	03
6	2039607	Software Engineering Lab	PCC LAB	0	0	3	40	60	1.5
7	2039608	Predictive Analytics Modeler Lab (IBM)	PCC LAB	0	0	3	40	60	1.5
8	2039609	Deep Learning Lab	PCC LAB	0	0	3	40	60	1.5
9	2024654	**Skill Course – IV:** Soft Skills Lab	SC	1	0	2	40	60	02
		Total					**360**	**540**	**21.5**

B.TECH. VI SEM (R20UG) SYLLABUS

Course Title	DEEP LEARNING				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039601	PCC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce the fundamentals of deep learning and the main research activities in this field.
- To learn architectures and optimization methods for deep neural network training.
- Study the neural networks and convolutions networks and their architecture.
- Gain knowledge about recurrent neural networks and deep supervised learning methods.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Understand the fundamentals of deep learning.
CO 2	Compare various deep neural network architectures.
CO 3	Apply various deep learning algorithms based on real-world applications.
CO 4	Understand the convents.
CO 5	Understand the recurrent neural networks.

UNIT – 1

Linear Algebra Review and Optimization: Brief review of concepts from Linear Algebra, Types of errors, bias-variance trade-off, overfitting-under fitting, brief review of concepts from Vector Calculus and optimization, variants of gradient descent, momentum.

UNIT – II

Logistic Regression: Basic concepts of regression and classification problems, linear models addressing regression and classification, maximum likelihood, logistic regression classifiers.

UNIT – III

Neural Networks: Basic concepts of artificial neurons, single and multi-layer perceptron, perceptron learning algorithm, its convergence proof, different activation functions, SoftMax cross entropy loss function.

UNIT – IV

Convnets: Basic concepts of Convolutional Neural Networks starting from filtering. Convolution and pooling operation and arithmetic of these, Discussions on famous convent architectures - AlexNet, ZFNet, VGG, Google Net, Res Net, MobileNet-v1

Regularization, Batchnorm: Discussion on regularization, Dropout, Batchnorm, Discussion on detection as classification, region proposals, RCNN architectures

UNIT – V

Recurrent Neural Networks: Basic concepts of Recurrent Neural Networks (RNNs), backpropagation through time, Long-Short Term Memory (LSTM) architectures, the problem of exploding and vanishing gradients, and basics of word embedding.

Auto Encoders: Autoencoders, Denoising autoencoders, sparse autoencoders, contractive

Autoencoders.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016
2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009.

Reference Books:

1. B. Vegnanarayana, Artificial Neural Networks, Prentice Hall of India, 2005.
2. Simon Haykin, Neural Networks a Comprehensive Foundations, PHI Edition, 2005.
3. Chao Pan, Deep Learning Fundamentals: An Introduction for Beginners, AI Sciences Publisher.

Course Title	SOFTWARE ENGINEERING				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039602	PCC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3 Hrs		

Course Objectives:

- Knowledge of basic Software engineering methods and practices, and their appropriate application also the software engineering layered technology and Process frame work.
- A general understanding of software process models such as the waterfall and evolutionary models.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Understanding of data models, object models, context models and behavioral models also different software architectural styles.
- Understanding of software testing approaches such as unit testing and integration testing other testing strategies and Risk management.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Ability to apply software engineering principles and techniques.
CO 2	Ability to develop, maintain and evaluate large-scale software systems.
CO 3	To produce efficient, reliable, robust and cost-effective software solutions.
CO 4	To manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.

UNIT - I

Software and Software Engineering: The Nature of Software, Software Engineering, Software Process Software Myths. Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

UNIT - II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, Data Modeling Concepts, Class-Based Modeling.

UNIT - III

Design Concepts: Design within the Context of Software Engineering, Design Process, Design Concepts, The Design Model.

Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, ArchitecturalDesign.

UNIT - IV

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis,Interface Design Steps, Design Evaluation.

Coding and Testing: Testing, Testing in the Large versus Testing in the Small, Unit Testing,

Integration Testing, Black-Box Testing, White-Box Testing, Debugging, System Testing.

UNIT - V

Software Project Management: Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO-A Heuristic Estimation Technique, Halstead's Software Science-An Analytical Technique, Risk Management.

Text Books:

1. Software Engineering: A practitioner's Approach, Roger S. Pressman, Seventh Edition, 2010, McGraw Hill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, 4th Edition, 2014, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education.
4. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

Reference Books:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
3. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition,2006.
4. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International edition, 2006.
5. Software Engineering Foundations, Yingxu Wang, Auerbach Publications,2008.

Course Title	PREDICTIVE ANALYTICS MODELER				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039603	PCC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- The Predictive Analytics Modeler career path prepares students to learn the essential analytics models to collect and analyze data efficiently.
- This will require skills in predictive analytics models, such as data mining, data collection and integration, nodes, and statistical analysis.
- The Predictive Analytics Modeler will use tools for market research and data mining in order to predict problems andimprove outcomes.

Course Outcomes: On successful completion of this course, the students will be able to	
CO1	The importance of analytics and how its transforming the world today
CO2	Understand how analytics provided a solution to industries using real case studies
CO3	Explain what is analytics, the various types of analytics, and how to apply it
CO4	Improve efficiency, sample records, and work with sequence data
CO5	Explain data transformations, and functions

Hardware Requirements	
Classroom (ILT) Setup Requirements	
Processor	Intel Core i7 CPU @ 2.7 GHz
GB RAM	8 GB
GB free disk space	60 GB
Network requirements	No
Other requirements	IBM ID

Notes: The following unit and exercise durations are estimates, and might not reflect every class experience. If the course is customized or abbreviated, the duration of unchanged units will probably increase.

Course Agenda:

MODULE I – Analytics Overview			
	Course I – Business Analytics Overview (Duration: 01 Hour)		
		Course Introduction: (Duration: 05 Minutes)	
		Unit – I: Analytics overview (Duration: 10 Minutes)	
		Overview	This unit provides an understanding of the importance of business analytics in our world,society, and life
		Learning objectives	After completing this unit, you should be able to: • Understand how analytics is transforming the world • Understand the profound impact of analytics in business decisions

			• Understand what is analytics and how it works • Understand why business analytics has become important in various industries
		Unit – 2: Analytics trends: Past, present & future (Duration: 15 Minutes)	
		Overview	This unit explains how analytics has evolved over time
		Learning objectives	After completing this unit, you should be able to: • Understand the history of analytics and how it has changed today • Understand how to analyze unstructured data • Understand how analytics is making the world smarter • Understand where the future of analytics lies
		Unit – 3: Towards a predictive enterprise (Duration: 05 Minutes)	
		Overview	This unit explains the effects of business analytics in the corporate world that has led to itsglobal adoption across geographies and industries
		Learning objectives	After completing this unit, you should be able to: • Explain why successful enterprises need business analytics • Understand how business analytics can help turn data into insight
		Unit – 4: Analytics: Industry domains (Duration: 05 Minutes)	
		Overview	This unit highlights the application of analytics across major industries.
		Learning objectives	After completing this unit, you should be able to: • Understand how predictive analytics is transforming all types of organizations • Explain how analytics supports retail companies • Understand how analytics can reduce crime rates and accidents • Explain the use of analytics in law enforcement and insurance companies • Understand how analytics can affect the future of education
		Unit – 5: Case studies and solutions (Duration: 15 Minutes)	
		Overview	This unit covers real case studies and solutions of the adoption of business analytics across theworld
		Learning objectives	After completing this unit, you should be able to: • Understand the importance of business analytics • Comprehend how big data and analytics can help in understanding consumer / customerbehavior • Explain how analytics can help manage assets • Understand how analytics can help combat fraud • Explain how analytics can help us to understand social sentiments
MODULE II – Business Analytics Foundations			
	Course I – Business Intelligence and Analytics 101 (Duration: 01 Hour)		
		Course Introduction: (Duration: 05 Minutes)	
		Business Intelligence and Analytics 101 (Duration: 01 Hour)	
		Overview	This course provides a collection of resources designed for participants to become familiar with business intelligence (BI) and analytics concepts. Participants will review materials to introduce themselves to terminology and practical business use cases for a high level understanding of BI and analytics. The course includes a pre-assessment for participants to measure their understanding of the content before taking the course, and a post-assessment for participants to gauge their learning after reviewing the materials
		Learning objectives	After completing this course, you should be able to: • Explain what is analytics • Define various types of analytics

			• Demonstrate how to apply analytics • Describe business intelligence • Demonstrate how to apply business intelligence
MODULE III – Predictive Analytics Modeler			
	Course I – Introduction to A Predictive Analytics Platform & Data Mining (Duration: 27.2 Hours)		
		Course Introduction: (Duration: 10 Minutes)	
		Unit – 1: Introduction to Data Mining (Duration: 01 Hour)	
		Overview	In this unit, you will learn about data mining and its applications
		Learning objectives	After completing this unit, you should be able to: • List two applications of data mining • Explain the stages of the CRISP-DM process model • Describe successful data-mining projects and the reasons why projects fail • Describe the skills needed for data mining
		Exercise 1 – The ACME business case: Modeling response for a campaign (Duration: 01 Hour)	
		Overview	In this exercise, you will learn how to apply data mining
		Learning objectives	After completing this exercise, you should be able to: • Understand data mining • Describe how to apply data mining in different scenarios
		Unit – 2: Working with IBM SPSS Modeler (Duration: 01 Hour)	
		Overview	In this unit, you will learn about objects such as streams and nodes and you will acquireexperience with the software.
		Learning objectives	After completing this exercise, you should be able to: • Describe the MODELER user-interface • Work with nodes • Run a stream or a part of a stream • Open and save a stream • Use the online Help
		Exercise 1 – Work with IBM SPSS Modeler (Duration: 45 Minutes)	
		Overview	In this exercise, you will learn about MODELER's user-interface to create streams
		Learning objectives	After completing this exercise, you should be able to: • Create streams • Change streams • Generate a select node from the Table output
		Unit – 3: Creating a data-mining project (Duration: 01 Hour)	
		Overview	In this unit you will learn about building a model and then applying that model to future cases ofa data-mining project.
		Learning objectives	After completing this unit, you should be able to: • Explain the basic framework of a data-mining project • Build a model • Deploy a model
		Exercise 1 – Create a data mining project to predict response in an ACME campaign (Duration: 45 Minutes)	
		Overview	In this exercise, you will build a model using data of the test mailing. This model (hopefully) identifies groups with high response rates. You will then use this model to select the groups with high response rates in the rest of the customer database (only these groups will be included in the actual mailing for the XL Original Orange Baseball Cap).

		Learning objectives	After completing this exercise, you should be able to: • Build a model using historical data • Deploy the model
		Unit – 4: Collecting initial data (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to collect initial data. You will also learn how to describe data.
		Learning objectives	After completing this exercise, you should be able to: • Explain the concepts of data structure, unit of analysis, field storage and field measurement level • Import Microsoft Excel files • Import text files • Import from databases • Export data to various formats
		Exercise 1 – Collect initial data for ACME (Duration: 45 Minutes)	
		Overview	In this exercise you will learn how to collect initial data for ACME
		Learning objectives	After completing this exercise, you should be able to: • Collect initial data for ACME
		Unit – 5: Understanding your data (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to explore data and assess it's quality.
		Learning objectives	After completing this exercise, you should be able to: • Audit the data • Explain how to check for invalid values • Take action for invalid values • Explain how to define blanks
		Exercise 1 – Understand the ACME data (Duration: 01 Hour)	
		Overview	In this exercise, you will learn how to understand the ACME data
		Learning objectives	After completing this exercise, you should be able to: • Import and examine data
		Unit – 6: Setting the unit of analysis (Duration: 01 Hour)	
		Overview	In this exercise, you will learn how to set unit of analysis in three different methods
		Learning objectives	After completing this exercise, you should be able to: • Set the unit of analysis by removing duplicate records • Set the unit of analysis by aggregating records • Set the unit of analysis by expanding a categorical field into a series of flag fields
		Exercise 1 – Set the unit of analysis for the ACME data (Duration: 45 Minutes)	
		Overview	In this exercise, you will learn how to set the unit of analysis for the ACME data.
		Learning objectives	After completing this exercise, you should be able to: • Cleanse data by removing duplicate records • Expand a categorical field into a series of flag fields
		Unit – 7: Integrating data (Duration: 01 Hour)	
		Overview	In this exercise you will learn how to combine different datasets into a single dataset foranalysis.
		Learning objectives	After completing this exercise, you should be able to:

			• Integrate data by appending records from multiple datasets • Integrate data by merging fields from multiple datasets • Sample records
		Exercise 1 – Integrate ACME data (Duration: 45 Minutes)	
		Overview	In this exercise, you will learn how to combine a number of datasets into a single dataset as apreparation for analysis and modeling.
		Learning objectives	After completing this exercise, you should be able to: • Append records from two datasets • Merge fields from different datasets • Enrich a dataset with aggregated data • Sample records
		Unit – 8: Deriving and reclassifying fields (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to construct the final dataset for modeling by cleansing andenriching your data.
		Learning objectives	After completing this exercise, you should be able to: • Use the Control Language for Expression Manipulation (CLEM) • Derive new fields & Reclassify field values
		Exercise 1 – Derive and reclassify fields for the ACME data (Duration: 45 Minutes)	
		Overview	In this exercise, you will learn how to cleanse and enrich a dataset to build models
		Learning objectives	After completing this exercise, you should be able to: • Cleanse data and derive fields for modeling • Cleanse data and reclassify fields for modeling
		Unit – 9: Identifying relationships (Duration: 01 Hour)	
		Overview	In this unit, you will learn methods used to examine the relationship between two fields
		Learning objectives	After completing this exercise, you should be able to: • Examine the relationship between two categorical fields • Examine the relationship between a categorical field and a continuous field • Examine the relationship between two continuous fields
		Exercise 1 – Identify relationships in the ACME data (Duration: 45 Minutes)	
		Overview	In this exercise you will learn how to assess relationships and determine its strength by doing ademo
		Learning objectives	After completing this exercise, you should be able to: • Assess the relationship between churn and handset • Assess the relationship between churn and number of dropped calls • Assess the relationship between number of products and revenues
		Unit – 10: Introduction to modeling (Duration: 01 Hour)	
		Overview	In this unit, you will learn about the modeling stage of the CRISP-DM process model.
		Learning objectives	After completing this exercise, you should be able to: • List three modeling objectives • Use a classification model • Use a segmentation model
		Exercise 1 – Predict response in ACME campaigns (Duration: 45 Minutes)	
		Overview	In this exercise you will learn about classification and segmentation using a synthetic datasetfrom a telecommunications firm

		Learning objectives	After completing this exercise, you should be able to: • Predict churn by running a CHAID model • Predict churn by running a Neural Net model • Compare the accuracy of these models • Find groups of similar customers, based on usage.
	Course II – Advanced data preparation using IBM SPSS Modeler (Duration: 13.75 Hours)		
		Course Introduction: (Duration: 10 Minutes)	
		Unit – 1: Using functions to cleanse and enrich data (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to use various different kinds of functions
		Learning objectives	After completing this unit, you should be able to: • Use date functions • Use conversion functions • Use string functions • Use statistical functions • Use missing value functions
		Exercise 1 – Using functions to clean and enrich travel agency data (Duration: 30 Minutes)	
		Overview	In this exercise you will work with data about customers and their holiday destinations. You will derive new fields to answer questions such as "What is the mean age of the customers?", "What was the most popular month to travel?", "What was the most popular destination?", and "What was the mean amount of money spent?"
		Learning objectives	After completing this exercise, you should be able to: • Use functions to clean and enrich travel data
		Unit – 2: Using additional field transformations (Duration: 01 Hour)	
		Overview	In this unit, you will learn about using additional field transformations.
		Learning objectives	After completing this exercise, you should be able to: • Replace values with the Filler node • Recode continuous fields with the Binning node • Change a field's distribution with the Transform node
		Exercise 1 – Use additional field transformations to prepare travel agency data for modeling (Duration: 01 Hour)	
		Overview	In this exercise, you will use additional field transformations to prepare travel agency data formodeling
		Learning objectives	After completing this exercise, you should be able to: • Use additional field transformations to prepare travel agency data
		Unit – 3: Working with sequence data (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to work with sequenced data.
		Learning objectives	After completing this exercise, you should be able to: • Use cross-record functions • Count an event across records • Expand a continuous field into a series of continuous fields with the Restructure node • Use geospatial and time data with the Space-Time-Boxes node
		Exercise 1 – Prepare sequence data of a travel agency for analysis (Duration: 45 Minutes)	
		Overview	In this exercise you will work with a dataset storing customers and their holidays. You will derive new fields to answer questions such as "What is the mean age of the customers?", "What was the most popular country?" and so forth.

		Learning objectives	After completing this exercise, you should be able to: • Prepare sequence data of a travel agency for analysis
		Exercise 2 – Determine the availability or taxis (Duration: 01 Hour)	
		Overview	In this exercise, you will learn how to determine the availability of taxis.
		Learning objectives	After completing this exercise, you should be able to: • Determine the availability of taxis
		Unit – 4: Sampling, partitioning, and balancing data (Duration: 01 Hour)	
		Overview	In this unit, you will learn how to use the Sample node and various reasons for samplingrecords
		Learning objectives	After completing this exercise, you should be able to: • Use the Sample node to draw simple and complex samples • Partition the data into a training and a testing set • Reduce or boost the number of records
		Exercise 1 – Sample, partition, and balance house property data (Duration: 45 Minutes)	
		Overview	In this exercise, you will sample, partition, and balance charity data
		Learning objectives	After completing this exercise, you should be able to: • Sample, partition, and balance charity data
		Unit – 5: Improving efficiency (Duration: 01 Hour)	
		Overview	In this exercise, you will learn how to work with SQL pushback, Set Globals node andparameters to optimize efficiency.
		Learning objectives	After completing this exercise, you should be able to: • Use database scalability by SQL pushback • Use the Data Audit node to process outliers and missing values • Use the Set Globals node • Use parameters • Use looping and conditional execution
		Exercise 1 – Improve efficiency with travel agency data (Duration: 45 Minutes)	
		Overview	In this exercise you will process outliers, extremes and missing values, using the Data Audit node. You will use the Set Globals node to replace missing values, and you will be introduced to automation by using parameters and looping.
		Learning objectives	After completing this exercise, you should be able to: • Use the Data Audit node to process outliers, extremes and missing values • Compute standardized scores using globals • Use parameters • Create a loop through values
		Course III – Predictive Analytics with IBM Watson Studio (Duration: 12 Hours)	
		Course Introduction: (Duration: 15 Minutes)	
		Unit – 1: Introduction to IBM Watson Studio (Duration: 30 Minutes)	
		Overview	This unit provides a high level overview of IBM Watson Studio, its components, key applicationsand the value added by the IBM offering
		Learning objectives	After completing this unit, you should be able to: • Describe Watson Studio. • Identify industry use cases. • List Watson Studio offerings & Create Watson Studio projects. • Describe Watson Studio and Spark environment.

			• Describe Watson Studio and Object Storage. • Explain Watson Studio high availability considerations. • Prepare and analyze data & Use Jupyter notebooks.
		Exercise 1 – Getting started with Watson Studio (Duration: 01 Hour 30 Minutes)	
		Overview	This exercise introduces you to the basic tasks that you perform when you use Watson Studio
		Learning objectives	• Create a Watson Studio project. • Manage the project & Assign collaborators. • Load a data set into the project's object store. • Manage Cloud Object Storage. • Analyze data by using Watson Studio. • Use scikit-learn for linear regression.
		Unit – 2: Introduction to IBM Watson Machine Learning (Duration: 01 Hour)	
		Overview	This unit provides an overview of the IBM Watson Machine Learning service available on IBMCloud. It explains the process of preparing the data before it is provided to machine learning algorithms. This unit describes the use of the Data Refinary tool to cleanse and shape tabular data with a graphical flow editor.
		Learning objectives	After completing this unit, you should be able to: • Describe data preparation before feeding into machine learning algorithms. • Describe Watson Machine Learning features and capabilities. • Describe the Data Refinery tool. • List the data formats and sizes that Data Refinery operates on. • List the Data Refinery features and explain each feature.
		Exercise 1 – Getting started with Watson Studio (Duration: 01 Hour)	
		Overview	In the first part, this exercise introduces you to the basic tasks of refining data with Data Refinery on Watson Studio. In the second part, it introduces you to Auto AI on Watson Studio formachine learning models creation.
		Learning objectives	After completing this exercise, you should be able to: • Import data into Data Refinery in an existing project. • Review the data with the Profile and Visualizations features • Refine the data by that use various shaping operations. • Run a job for the Data Refinery flow. • Create a model by using the Auto AI graphical tool in Watson Studio.
		Unit – 3: Introduction to neural networks and deep learning (Duration: 01 Hour 90 Minutes)	
		Overview	This unit introduces machine learning models that are inspired by the structure of the human brain, which is known as neural networks. Then, this unit provides an overview to deep learning, which is a machine learning technique that uses neural networks to learn.
		Learning objectives	After completing this unit, you should be able to: • Describe neural networks. • Explain the concepts of Perceptron and back propagation. • Explain what an activation function is and identify the most common examples. • Articulate the difference between deep and shallow neural networks. • List the reasons for the current deep learning emergence. • Identify the basic architectures of deep neural networks and their applications. • Describe the functions of IBM Watson Studio Neural Network Modeler.

		Exercise 1 – Exploring deep learning and neural network modeling with Watson Studio (Duration: 01 Hour 30 Minutes)	
		Overview	This exercise guides you step-by-step through the design of a deep learning neural network architecture based on a sample flow that is provided to you. You create your own convolutionalneural network with Watson Studio.
		Learning objectives	After completing this exercise, you should be able to: • Build a neural network to recognize handwritten digits. • Create a neural network design flow by using the neural network modeler. • Train models with experiment builder.
		Unit – 4: IBM Watson Studio Jobs (Duration: 30 Minutes)	
		Overview	This unit describes how to use IBM Watson Studio Jobs to run data operations assets such as notebooks and Data Refinery flows. This unit explains how to create and run jobs from a DataRefinery flow and a notebook.
		Learning objectives	After completing this unit, you should be able to: • Explain the purpose and function of jobs. • Explain how to create jobs by using a project, Data Refinery flow, or a Notebook. • Describe how to view, edit, and run jobs. • Use Watson Studio Jobs on a practical use case to automate model training anddeployment.
		Exercise 1 – Automating data preparation, model training, and deployment with Watson Studio jobs (Duration: 01 Hour 30 Minutes)	
		Overview	This exercise demonstrates how to use Watson Studio jobs to run an end to end scenario in a data science project. You use previously developed artifacts to create Watson Studio jobs to prepare your data, train the model, deploy the trained model, and score your data.
		Learning objectives	After completing this exercise, you should be able to: • Create data preparation jobs from Data Refinery flows. • Create jobs from notebooks to train, evaluate, and deploy models. • Create jobs from notebooks to score your data.

Course Title	CRYPTOGRAPHY & NETWORK SECURITY (Professional Elective Course – II)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039604	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Min					End Exam Duration: 3Hrs		

Course Objectives:

- Extensive, thorough and significant understanding of the concepts, issues, principles and theories of computer network security
- Identifying the suitable points for applying security features for network traffic
- Understanding the various cryptographic algorithms and implementation of the same.
- Understanding the various attacks, security mechanisms and services.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO 2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
CO 3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO 4	Apply different digital signature algorithms to achieve authentication and create secure applications.
CO 5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CO 6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT – I

Computer Security concepts, The OSI Security Architecture, Security attacks, Security services and Security mechanisms, A model for Network Security, Classical encryption techniques-symmetric cipher model, substitution ciphers, transposition ciphers, Steganography, Modern Stream ciphers.

UNIT – II

Modern Block Ciphers: Block ciphers principles, Data encryption standard (DES), Strength of DES, Block cipher modes of operations, AES, RC4.

Introduction to Number theory: Integer Arithmetic, Modular Arithmetic, Linear Congruence, Algebraic Structures, GF(2n) Fields, Primes, Factorization, Chinese remainder Theorem, Quadratic Congruence.

UNIT – III

Public-key cryptography: Principles of public-key cryptography, RSA Algorithm, Diffie-Hellman Key Exchange, EL Gamal cryptographic system.

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA).

UNIT – IV

Message Authentication Codes: Message authentication Requirements, Message authentication functions, Message authentication codes, security of MACs, HMAC.

Digital Signatures: Digital Signatures, Schnorr Digital Signature Scheme, Digital SignatureStandard.

UNIT – V

User Authentication: Remote user Authentication Principles, Kerberos

Electronic mail security: Pretty Good Privacy (PGP), S/MIME Worms, Viruses, Firewalls.

Text Books:

1. Cryptography and network Security by Fourth edition, Stallings, PHI/Pearson
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH.
3. Network Security: The complete reference by Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T. Gangemi Sr., SPD O'REILLY.

Reference Books:

1. Cryptography and network Security by Atul Kahate, 4th Edition, Tata McGraw Hill
2. Understanding Cryptography, Christof Paar. Jan Pelzl, Springer.
3. Introduction to Modern Cryptography, Jonathan Katz, Yehuda Lindell, 2nd Edition, CRC

Course Title	CLOUD COMPUTING (Professional Elective Course – II)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039605	PEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To explain the cloud paradigms.
- To introduce the various levels of services that can be achieved by cloud.
- To know about service providers of cloud.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall different computing paradigms
CO 2	Understand the evolution of cloud computing paradigm and its architecture, and characterizing different cloud deployment models.
CO 3	Explain service models and Virtualization.
CO 4	Understand programming models and Software Development in Cloud Computing.
CO 5	Identify the Data Center environment and service providers in cloud computing.

UNIT – I

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Biocomputing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing, Network Computing.

Cloud Computing Fundamentals: Motivation for Cloud Computing: The Need for Cloud Computing. Defining Cloud Computing: NIST Definition of Cloud Computing, Computing Is a Service, Cloud Computing Is a Platform. Principles of Cloud computing: Five Essential Characteristics, Four CloudDeployment Models, Three Service Offering Models, Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks.

UNIT – II

Cloud Computing Architecture and Management: Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud.

Cloud Deployment Models: Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud.

UNIT – III

Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models.

Virtualization: introduction, Virtualization opportunities, Approaches to virtualization,Hypervisors, From virtualization to cloud computing,

UNIT – IV

Programming Models in Cloud: Cloud Application Development Platforms: Windows Azure, Google App Engine, Force.com, Manjrasoft Aneka.

Software Development in Cloud: Introduction, Different perspectives on SaaS development, New challenges, Cloud aware software development using PaaS technology

UNIT – V

Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers. **Cloud Service Providers:** Introduction, EMC, Google, Amazon Web Services, Microsoft, IBM,Salesforce, Rackspace.

Text Books:

1. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.
2. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems andApplications, Springer, 2012.
3. K. Chandrasekaran, Essentials of Cloud Computing, CRC Press, 2015.
4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, CloudComputing: Principles and Paradigms, Wiley, 2011

Reference Books:

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, TataMcGraw Hill.
2. Cloud Computing Theory and Practice: Dan C. Marinescu, Elsevier.
3. Cloud Computing Bible, Barrie Sosinsky, Wiley Publishing.
4. Cloud Computing and Virutualization, Dac-Nhuong Le, Raghavendra Kumar,Gia Nhu Nguyen, Jyir Moy Chatterjee, Wiley.

Course Title	COMPUTATIONAL INTELLIGENCE (Professional Elective Course – II)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
2039606	PEC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Computational Intelligence is the successor to Artificial Intelligence
- Offering special benefits in its applications in certain areas like Classification, Regression, Pattern Matching, Control, Robotics, Data Mining etc.
- To introduce the basic tools and techniques in Computational Intelligence such as Neural Networks
- Understands the concepts of Genetic Algorithms from an application perspective to the students
- Understand the fuzzy logic concepts and build the fuzzy logic systems

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Provide a basic exposition to the goals and methods of Computational Intelligence
CO 2	Apply the Intelligent techniques for problem solving
CO 3	Understand and compare neural networks with other information processing methods.
CO 4	Understand the fuzzy logic concepts and build the fuzzy logic systems
CO 5	Apply fuzzy logic principles and thinking to deal with vulnerability and tackle real time issues.

UNIT – I

Introduction: Background and history of evolutionary computation, Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption, Self-organization and Evolution, Historical Views of Computational Intelligence, Adaption and Self-organization for Computational Intelligence, Ability to Generalize, Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

UNIT – II

Review of evolutionary computation theory and Concepts: History of Evolutionary Computation, Evolution Computation Overview, Genetic algorithms, Evolutionary programming, Evolution strategies, genetic programming, and particle swarm optimization.

UNIT – III

Review of basic neural network theory and Concepts: Neural Network History, What Neural Networks are and Why they are useful, Neural Networks Components and Terminology, Neural Networks Topology, Neural Network Adaption, Comparing Neural Networks and Other information Processing Methods, Preprocessing and Post Processing.

UNIT – IV

Fuzzy Systems Concepts and Paradigms: Fuzzy sets and Fuzzy Logic, Theory of Fuzzy sets, Approximate Reasoning, Fuzzy Systems Implementations, Fuzzy Rule System Implementation.

UNIT – V

Computational Intelligence Implementations: Implementation Issues, Fuzzy Evolutionary Fuzzy Rule System Implementation, Best tools, Applying Computational Intelligence to Data Mining. Performance Metrics: General Issues, Percent Correct, Average Sum-squared Error.

Text Books:

1. Eberhart & Shi "Computational Intelligence - Concepts to Implementations

Reference Books:

1. Melanie Mitchell "Introduction to Genetic Algorithms"
2. Davis "Handbook of Genetic Algorithms"
3. Tom Mitchel - Machine Learning

Course Title	PRINCIPLES OF OPERATING SYSTEMS (Open Elective Course – II)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
20OE506	OEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- Have an overview of functions of operating systems.
- Have a thorough knowledge of process management and memory management.
- To have a thorough knowledge of how handle to deadlocks.
- Learn the concepts of files, protection and security

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Understand the basic concepts related to the operating systems
CO2	Analyze the various process scheduling algorithms and process synchronization mechanisms.
CO3	Analyze the various memory management schemes.
CO4	Understand the ways to deal the deadlocks and the basic concepts related to files in the system.
CO5	Analyze the protection and security mechanism.

UNIT – I

Operating Systems Basics: Operating systems functions, Overview of computer operating systems, distributed systems, operating system services and systems calls, system programs, operating system structure.

UNIT – II

Process Management: Process concepts, scheduling-criteria, CPU scheduling algorithms, Evaluation of Scheduling Algorithms.

Concurrency: Process synchronization, the critical-section problem, Peterson's Solution, semaphores, Classic problems of Synchronization, monitors.

UNIT – III

Memory Management: Introduction**,** Swapping, contiguous memory allocation, paging,structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, Allocation of frames.

UNIT – IV

Deadlocks: system model, deadlock characterization, deadlock prevention,detection and avoidance, recovery form deadlock.

Files: The concept of a file, Access Methods, File Allocation Methods.

UNIT – V

Protection: Protection, Goals of Protection, Principles of Protection, Domain of protection Access Matrix, Implementation of Access Matrix.

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts", Eighth edition, John Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Fourth Edition, PearsonEducation.
3. William Stallings, "Operating Systems: Internals and Design Principles", Sixth Edition2009, Pearson Education.
4. D.M. Dhamdhere, "Operating Systems, A Concept based Approach", Third Edition,TMH.

Reference Books:

1. A.S. Godbole, "Operating Systems", Second Edition, TMH.
2. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition.
3. Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson.
4. Operating Systems: A Practical Approach, Rajiv Chopra, 4th Edition, S Chand Publishers.

Course Title	DATABASE MANAGEMENT SYSTEMS (Open Elective Course – II)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
		L	T	P	C	ContinuousInternal Assessment	End Exams	Total
20OE502	OEC	3	0	0	3	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3Hrs		

Course Objectives:

- To study the physical and logical database designs, database modeling, relational hierarchical, and network models.
- To understand and use data manipulation language to query, update, and managing the database.
- To develop an understanding of essential DBMS concepts such as: database secure integrity and concurrency.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the basic concepts and the application of Database systems.
CO 2	To understand the basics of SQL and construct queries using SQL.
CO 3	To understand the Relational Database design principles.
CO 4	To apply various Normalization techniques for database design improvement.
CO 5	To apply concurrency control and recovery techniques during transaction execution.

UNIT – I

Introduction - Database-System Applications, View of Data, Database languages, Database architecture, Database Users and Administrators.

E-R Model - The Entity Relationship Model, Constraints, Entity Relationship Diagrams, and Extended E-R features.

UNIT – II

Relational Model - Structure of Relational Databases, Database Schema, Keys, Query Languages, Fundamental Relational Algebra Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations, Modification of Database.

UNIT – III

Introduction to SQL - Data Definition, Basic Structure of SQL Queries, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Complex queries, views, Modification of the Database.

Advanced SQL -Integrity Constraints, Dynamic SQL, Functions and Procedures.

OtherRelational Query Languages - Tuple Relational Calculus, Domain Relational calculus.

UNIT – IV

Normal Forms – Atomic domain and First Normal Form, Keys and Functional Dependencies, Second Normal Form, BCNF, BCNF and Dependency Preservation, Third Normal Form, Lossless Decomposition, Dependency- preserving, Multi valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form, and Inclusion dependencies.

UNIT – V

Transactions -Transaction Concept, Transaction State, Implementation of TransactionAtomicity and Durability, Concurrent Executions, Serializability.

Concurrency Control -Lock-Based Protocols, Timestamp-Based Protocols.

RecoverySystem - Failure Classification, Storage, Recovery and Atomicity, Log based recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan," Database system Concepts", 5thEdition, McGrawhill.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", PearsonEducation, 3rd Edition, 2003
3. C.J.Date, "Introduction to Database", 8 Th Edition, 2003, Addison-Wesley publication.
4. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States 1st Edition, 2000

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems.3rd Edition, Tata McGrawHill.
2. Peter Rob, Ananda Rao and Carlos Corone, Database Management Systems,Cengage Learning, 1st Edition, 2011.
3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.
4. S.K.Singh, "Database Systems Concepts, Design and Applications", First Edition,Pearson Education, 2006.

Reference Links:

1. https://nptel.ac.in/courses/106/105/106105175/ (IIT KHARAGPUR)
2. https://nptel.ac.in/courses/106/106/106106095/ (IIT MADRAS)

Course Title	SOFTWARE ENGINEERING LAB				B.Tech. VII Sem (R20UG) AI&ML			
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2039712	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
Mid Exam Duration: 90 Minutes					End Exam Duration: 3 Hrs			

Course Objectives:

- To analyze and design solutions to problems using object-oriented approach.
- To make the student to learn and apply the process of object-oriented analysis and design to solve complex problems with the different applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze problems using object-oriented approach
CO 2	Design structural and behavioral diagrams
CO 3	Apply forward engineering to the given problems
CO 4	Design object-oriented models using UML.
CO 5	Develop real time applications using object-oriented concepts

List of Programs:

To develop a mini project the following 12 exercises listed below:

1. To develop a problem statement.
2. Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
3. Identify Use Cases and develop the Use Case model.
4. Identify the business activities and develop an UML Activity diagram.
5. Identity the conceptual classes and develop a domain model with UML Class diagram.
6. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7. Draw the State Chart diagram.
8. Identify the User Interface, Domain objects, and technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
9. Implement the Technical services layer.
10. Implement the Domain objects layer.
11. Implement the User Interface layer.
12. Draw Component and Deployment diagrams.

Suggested domains for Mini project:

1. Passport automation system
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Pearson Education, 2nd Edition.

Reference Books:

1. Erich Gamma, Richard Belm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object Oriented Software, Addison-Wesley, 1994.
2. Meilir Page-Jones, Fundamentals of Object Oriented Design in UML, Pearson Education, 2000.
3. Atul Kahate, Object Oriented Analysis & Design, McGraw-Hill, 2004.

Course Title	DEEP LEARNING LAB				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2039609	PCC	L	T	P	C	ContinuousInternal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- Learn different activation functions and optimization techniques used in neural networks.
- Know the applications of deep learning models for binary and multiclass classification.
- Understand the architectures of CNN, RNN, LSTM and GRU.
- Explore various types of Categorical Data Encoding Schemes

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Illustrate Perceptron training algorithm and apply various activation functions.
CO 2	Design multi-layer neural network with Back propagation algorithm and evaluate the performance of various optimization techniques.
CO 3	Build Deep Learning models for binary and multiclass classification problems.
CO 4	Compare the application of Deep learning models CNN, RNN, LSTM and GRU
CO 5	Use data encoding schemes and develop Deep learning models for real world applications.

List of Programs:

1. Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
2. Implement Perceptron training algorithm to classify flowers in IRIS dataset.
3. Implement Activation Functions in Neural Networks and analyze their usage.
4. Build a three-layer Artificial Neural Network by implementing the Back propagation algorithm.
5. Design a GRU-based deep learning model for IMDB dataset. Compare the performance of GRU based model with LSTM based model
6. Build a Deep Neural Network for multi class text classification using Reuters dataset
7. Design a model for MNIST handwritten digit classification using Deep Convolution Neural networks.
8. Train a simple Recurrent Neural Network using an Embedding layer and a Simple RNN layer for movie review classification problem.
9. Build a Deep learning model using LSTM layer in Keras for IMDB dataset.
10. Design a Neural network with various optimization algorithms and analyze their performance using Keras.

Text Books:

1. Deep Learning with Python, Francois Chollet, Manning Publications Co.
2. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms with contributions by Nikhil Buduma , O'Reilly publications
3. Francois Chollet, "Deep learning with Python" – Manning Publications.

Reference Books:

1. Deep Learning, Ian Good fellow, Yoshua Bengio and Aaron Courville, MIT Press, London, England.
2. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibs, O'Reilly publications.

Course Title	SOFTSKILLS LAB (Skill Course – IV)				B.Tech. VI Sem (R20UG) AI&ML		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2024654	SC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	0	3	2	40	60	100
					End Exam Duration: 3 Hrs		

Course Objectives:

- Encourage all round development of the students by focusing on soft skills
- Outline the required skills such as interpersonal skills, communication skills.
- Aware of critical thinking and problem solving skills
- Develop leadership skills and organizing skills through group activities
- Function effectively with heterogeneous teams

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the attributes of soft skills
CO 2	Understand the importance of soft skills for effective and harmonious relations
CO 3	Analyze the reasons for stress and techniques to handle for efficient performance
CO 4	Illustrate the points in multi tasks and prioritizing
CO 5	Classify communication, motivation, teamwork, time management, work ethic and flexibility

UNIT – I

Soft Skills: Introduction, meaning, Listing Soft Skills, significance of soft skills – Discussion on essential soft skills, methods to inculcate soft skills.

UNIT – II

Team Player Attitude: What is an Attitude – Attitude towards others – Importance of 'Can Do' Attitude – Openness to New Ideas – Work Behavior.

UNIT – III

Problem Solving & Decision Making: Meaning & Features of Problem Solving - Managing Conflict – Conflict Resolution – Methods of Decision Making – Effective Decision Making in Teams – Methods and Styles.

UNIT – IV

Leadership Skills: Team Building – Decision Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking – Time Management.

UNIT – V

Work Ethics: Definition – Important work Ethics – Developing A Strong Work Ethic Nature in an Organization - Role and Importance of Working Ethics in a Workplace**.**

Suggested Software: Walden

Text Books

1. Personality Development and Softskills (English, Paperback, Mitra Barun K) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Soft Skills by Alex K. Published by S. Chand
3. Soft Skills: An Integrated Approach to Maximize Personality, Gajendra Singh Chauhan
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. Soft Skills for a BIG IMPACT (English, Paperback, RenuShorrey) Publisher: Notion Press.

Reference Books

1. Peggy Klaus, The Hard Truth about Soft Skills
2. The Ace of Soft Skills, Gopalswamy Ramesh, Mahadevan Ramesh, Pearson Education India.
3. Eric Garner – Team Building.
4. Carnegie Dale, How to Win Friends and Influence People, New York, Fireside Publishers, 1998
5. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.
6. Convey Sean, Seven Habit of Highly Effective Teens, New York, Fireside Publishers,1998.