

# **BOARD OF STUDIES**

## **B.VOC - DATA SCIENCE**



Since 1881

# **THE AMERICAN COLLEGE**

Re-accredited (3<sup>rd</sup> cycle) by NAAC with Grade “A<sup>+</sup>”, CGPA – 3.47 on a 4 point scale

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

**Madurai – 625 002**

**B.Voc. / M.Voc.**

**Degree Programmes**

**Learning Outcomes-based Curriculum Framework**

**(LOCF)**

**2024-2025**

**5<sup>th</sup> August 2024**

## **Program Outcomes (POs) for B.Voc**

### **PO1: Disciplinary Knowledge**

Demonstrate comprehensive knowledge and understanding of the disciplines constituting the B. Voc programme, integrating both theoretical and practical aspects.

### **PO2: Critical Thinking and Problem-Solving**

Exhibit the ability to think critically and creatively to analyze problems, evaluate solutions, and make informed decisions using the knowledge acquired from the B. Voc programme.

### **PO3: Communication Skills**

Demonstrate effective listening skills and communicate information accurately and clearly.

### **PO4: Information/digital literacy**

Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.

### **PO5: Leadership and Teamwork Abilities**

Learn to work effectively both as a team member and a leader, demonstrating the ability to guide and manage teams towards achieving common goals.

### **PO6: Ethical Thinking and Effective Citizenship**

Act with an informed awareness of moral and ethical issues, demonstrating empathetic social concern, equity-centred national development, and a commitment to professional ethics and responsibility.

### **PO7: Environmental Awareness and Sustainability**

Understand the impact of scientific solutions in societal and environmental contexts and demonstrate knowledge of the necessity for sustainable development.

### **PO8: Lifelong Learning**

Develop the ability to continuously learn and adapt, equipping oneself for lifelong personal and professional growth.

### **PO9: Entrepreneurial Abilities**

Demonstrate the capability to establish independent ventures or innovation centres.

**PO10: Business Opportunities and Innovation** - Identify business opportunities and devise and implement innovative solutions within the workplace.

## **Programme Specific Outcomes (PSOs) for B.Voc**

### **PSO1: Disciplinary Knowledge**

Attain a thorough understanding of fundamental theoretical concepts and practical skills in entrepreneurship development, retail, logistics, and business.

### **PSO2: Critical Thinking & Problem-Solving**

Develop creative and critical thinking abilities to effectively address and overcome diverse challenges in the corporate environment.

### **PSO3: Communication Skills**

Effectively communicate complex ideas and activities with team members and the wider community through reports, presentations, and clear instructions.

### **PSO4: Information/Digital literacy**

Utilize information and communication technology tools effectively and incorporate the knowledge of skills in their respective discipline.

### **PSO5: Leadership and Teamwork Abilities**

Demonstrate leadership, teamwork skills and professional effectiveness in the field.

### **PSO6: Ethical Thinking and Effective Citizenship**

Inculcate moral and ethical practices in personal and professional contexts

### **PSO7: Environmental Awareness and Sustainability**

Gain the skills needed to implement a eco-friendly solutions within their respective fields.

### **PSO8 Lifelong Learning**

Commit to ongoing personal and professional growth through evolving knowledge and skills in a rapidly changing world.

### **PSO9: Entrepreneurial Abilities**

Exhibit the capability to work professionally while developing entrepreneurial, conceptual, leadership, and interpersonal skills.

### **PSO10: Business Opportunities and Innovation**

Position themselves as proficient professionals capable of occupying various white-collar positions across industries.

**B.Voc. Degree Programme**  
**Learning Outcomes-based Curriculum Framework**  
w.e.f 2024 – 2025

<b>I YEAR</b>						
Component	Part	Course	Semester I		Semester II	
			Hours	Credits	Hours	Credits
GEC	I	Tamil	3	2	3	2
	II	English	3	2	3	2
SC	III	CC (3)	16	12	16	12
		Internship	-	6	-	6
GEC	IV	SEC	4	4	4	4
		AEC (EVS/VAL)	4	4	4	4
Extension Activity	V	SLP/GMP/LIB	-	-	-	1
<b>Total</b>			<b>30</b>	<b>30</b>	<b>30</b>	<b>30+1</b>
<b>II YEAR</b>						
Component	Part	Course	Semester III		Semester IV	
			Hours	Credits	Hours	Credits
GEC	I	Tamil	3	2	3	2
	II	English	3	2	3	2
SC	III	CC (3)	16	12	16	12
		Internship	-	6	-	6
GEC	IV	SEC (2)	8	8	8	8
Extension Activity	V	SLP/GMP/LIB	-	-	-	1
<b>Total</b>			<b>30</b>	<b>30</b>	<b>30</b>	<b>30+1</b>
<b>III YEAR</b>						
Component	Part	Course	Semester V		Semester VI	
			Hours	Credits	Hours	Credits
SC	III	CC (3)	18	12	18	12
		Internship	-	6	-	6
GEC	IV	SEC(3)	12	12	12	12
<b>Total</b>			<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>Total Credits = 180</b>						

GEC – General Education Component    SC – Skill Component

**Department of Data Science (B.Voc.)**  
**Learning Outcomes-based Curriculum Framework**  
(w.e.f 2024-2025)

Sem	Component	Part	Course Code	Course Title	Hours/ Wk.	Credits		
						GEC	SC	Total
1	GEC	I	24TAV1201	Tamil	3	2	-	2
		II	24ENV1201	English	3	2	-	2
	SC	III CC	24BDS1401	Relational Database Management System	4	-	4	4
		III CC	24BDS1403	Introduction to Data Science	4	-	4	4
		III CC-LAB	24BDS1405	Relational Database Management System Lab	8	-	4	4
		III CC	24BDS1611	Internship – I	-	-	6	6
	GEC	IV SEC	24MDV1401	Basic Mathematics	4	4		4
		IV AEC	24ESV1401	Environmental Studies	4	4		4
Extension Activity	V	24XXXNNNN	SLP/GMP/LIB	-	-	-	-	
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30</b>
2	GEC	I	24TAV1202	Tamil	3	2	-	2
		II	24ENV1202	English	3	2	-	2
	SC	III CC	24BDS1402	Cloud Computing	4	-	4	4
		III CC	24BDS1404	Programming in Java	4	-	4	4
		III CC-LAB	24BDS1406	Programming in Java Lab	8	-	4	4
		III CC	24BDS1622	Internship – II	-	-	6	6
	GEC	IV SEC	24PDV1402	Digital Principles	4	4		4
		IV SEC	24VEV1402	Youth in the Global Context	4	4		4
Extension Activity	V	24XXXNNNN	SLP/GMP/LIB	-	-	-	1	
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30+1</b>
3	GEC	I	24TAV2201	Tamil	3	2	-	2
		II	24ENV2201	English	3	2	-	2
	SC	III CC	24BDS2401	Artificial Intelligence and Machine Learning	4	-	4	4
		III CC	24BDS2403	Data Analytics	4	-	4	4
		III CC-LAB	24BDS2405	Data Analytics using excel Lab	8	-	4	4
		III CC	24BDS2633	Internship – III	-	-	6	6
	GEC	IV SEC	24MDV2401	Statistics – I	4	4	-	4
		IV SEC	24LSV2401	Fundamentals of Life Coping Skills	4	4	-	4
Extension Activity	V	24XXXNNNN	SLP/GMP/LIB	-	-	-	-	
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30</b>

4	GEC	I	24TAV2202	Tamil	3	2	-	2
		II	24ENV2204	English	3	2	-	2
	SC	III CC	24BDS2402	Python Programming	4	-	4	4
		III CC	24BDS2404	Deep Learning	4	-	4	4
		III CC-LAB	24BDS2406	Python Programming Lab	8	-	4	4
		III CC	24BDS2644	Internship – IV	-	-	6	6
	GEC	IV SEC	24MDV2402	Statistics – II	4	4	-	4
		IV SEC	24LSV2402	Performance & Life Coping Skills	4	4	-	4
Extension Activity	V	24XXXNNNN	SLP/GMP/LIB	-	-	-	1	
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30+1</b>
5	SC	III CC	24BDS3401	R Programming	5	-	4	4
		III CC	24BDS3403	Data Visualization	5	-	4	4
		III CC-LAB	24BDS3405	R Programming Lab	8	-	4	4
		III CC	24BDS3655	Internship – V	-	-	6	6
	GEC	IV SEC	24MDV3401	Linear Algebra	4	4	-	4
		IV SEC	24LSV3401	Entrepreneurship Development	4	4	-	4
		IV SEC	24LSV3403	Coping with Psychological & Physical Issues	4	4	-	4
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30</b>
6	SC	III CC	24BDS3402	Reinforcement Learning	5	-	4	4
		III CC	24BDS3404	Data Security	5	-	4	4
		III CC-LAB	24BDS3406	Reinforcement Learning using Python Lab	8	-	4	4
		III CC	24BDS3666	Internship – VI	-	-	6	6
	GEC	IV SEC	24MDV3402	Graph Theory	4	4	-	4
		IV SEC	24LSV3402	Soft Skills	4	4	-	4
		IV SEC	24LSV3404	Coping with Social & Environmental Issues	4	4	-	4
<b>Total</b>					<b>30</b>	<b>12</b>	<b>18</b>	<b>30</b>

GEC – General Education Component SC – Skill Component

**Total Credits = 180 + 2**

**Mapping with POs**

BDS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
		3	3	3	2	3	2	2	1	1

### Mapping of Courses with PSOs

<b>Courses</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
24BDS1401	3	2	2	2	3	2	2	1	1	1
24BDS1403	3	2	2	2	3	2	2	1	1	1
24BDS1405	3	2	2	2	3	2	2	1	1	1
24BDS1611	3	3	3	2	2	2	1	1	1	1
24BDS1402	3	3	2	2	3	2	2	2	2	3
24BDS1404	3	2	3	3	2	2	2	1	2	2
24BDS1406	3	2	3	3	2	2	2	1	1	2
24BDS1622	3	3	3	2	2	2	1	1	1	1
24BDS2401	3	3	2	2	2	2	1	1	1	1
24BDS2403	3	3	3	2	2	2	2	1	1	1
24BDS2405	3	2	2	2	2	2	1	1	1	1
24BDS2633	3	3	3	2	2	2	1	1	1	1
24BDS2402	3	2	3	3	2	2	2	1	2	3
24BDS2404	3	3	3	3	2	2	2	1	1	1
24BDS2406	3	2	3	3	2	2	2	1	2	3
24BDS2644	3	3	3	2	2	2	1	1	1	1
24BDS3401	3	2	3	3	2	3	2	2	3	3
24BSD3403	3	3	2	2	3	2	1	2	2	3
24BDS3405	3	2	3	3	2	2	2	1	2	1
24BDS3655	3	3	3	2	2	2	1	1	1	1
24BDS3402	3	3	3	2	2	2	1	1	1	1
24BSD3404	3	3	3	2	2	2	1	1	1	1
24BDS3406	3	3	3	2	2	2	1	1	1	1
24BDS3666	3	3	3	2	2	2	1	1	1	1
<b>Average</b>	<b>3</b>	<b>2.5</b>	<b>2.7</b>	<b>2.3</b>	<b>2.2</b>	<b>2</b>	<b>1.5</b>	<b>1.1</b>	<b>1.3</b>	<b>1.5</b>

### Mapping of Courses with POs

<b>Courses</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
24MDV1401	3	3	3	2	3	2	2	1	1	1
24PDV1402	3	3	2	2	3	2	2	2	2	3
24MDV2401	3	3	3	2	3	2	2	1	1	1
24MDV2402	3	3	3	2	3	2	2	1	2	1
24MDV3401	3	2	3	2	3	2	1	1	2	1
24MDV3402	3	2	2	2	3	2	2	1	2	1
<b>Average</b>	<b>3</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1.8</b>	<b>1.1</b>	<b>1.6</b>	<b>1.3</b>

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS1401	Relational Database Management Systems	CC	4	4

The aims of this course is to learn the basic concept of Database with different database model in detail and also extensively covers the Normalization process, overview of Entity Relationship Model, Relational Database Design and Transaction concepts. It covers practical concepts of SQL and PL/SQL.

### **Course Outcomes**

At the end of the course, students will be able to

CO1: Learn the fundamentals of Data Models and to represent a Database system.

CO2: Express the basic concepts of SQL and PL/SQL.

CO3: Gain knowledge about Entity Relationship Model.

CO4: Gain an introductory knowledge about Relational Database Design.

CO5: Understand the fundamental concepts of Transaction Processing and Concurrency Control Techniques.

### **UNIT – I: Database and Database Users**

**12Hours**

What is Database –characteristics of Database – What is DBMS – Advantages and Disadvantages of DBMS – Database Architecture – Two Tier Architecture – Three Tier Architecture – Schema Architecture – Database Models – Database administrator and Database users.

### **UNIT – II: SQL**

**12Hours**

Introduction to SQL –Data Definition Language – Data Manipulation Language – Transaction Control Language – Data Control Language- Data Types

### **UNIT III: SQL Joins**

**12Hours**

SQL Joins - Set operations - Aggregate functions– SQL Sub Queries –Referential integrity –SQL Operators-SQL Order By-SQL Group By

### **UNIT – IV: E-R Model**

**12Hours**

E-R diagram – Entity Set – Relationship – Degree - Weak Entity Set - Relational algebra – Keys – Need of Keys – Types of keys –constraints

### **UNIT – V: Functional Dependencies and Normalization**

**12Hours**

Design guidelines for relation schemas- Functional dependencies –normal forms - definitions of norm forms - first normal form - second and third normal forms- Boyce codd normal forms- Transaction processing

## Learning Resources

### Text Books

1. Fundamentals of Database Systems - RAMEZ ELMASRI, SHAMKANT B.NAVATHE - Fifth Edition - Pearson Publications, New Delhi-2009.

### Reference Books

1. Database Management Systems - G.K.Gupta - Second Edition - PHI Learning Private Limited, New Delhi-2008.
2. Database Management concepts - Raghurama Krishnan, Johannes Gehrke - Third Edition - Tata Mc Graw Hill, New Delhi-2009.

### Websites/ e-Learning Resources

1. <http://srikanthtechnologies.com/books/orabook/ch1.pdf>
2. [http://www.tmv.edu.in/pdf/Distance\\_education/BCA%20Books/BCA%20IV%20SEM/BCA-428%20Oracle.pdf](http://www.tmv.edu.in/pdf/Distance_education/BCA%20Books/BCA%20IV%20SEM/BCA-428%20Oracle.pdf)
3. <http://www.tutorialspoint.com/sql/sql-rdbms-concepts.html>
4. <http://ecomputernotes.com/database-system/rdbms>
5. <http://www.mithunashok.com/2011/04/basics-of-rdbms.html>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	2	2	3	2	2	1	1	1
CO2	3	2	2	3	3	2	2	1	1	1
CO3	3	3	2	2	2	2	2	1	1	1
CO4	3	2	2	2	3	2	2	1	1	1
CO5	3	3	3	2	2	3	2	1	1	1
Average	3	2.4	2.2	2.2	2.6	2.2	2	1	1	1

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS1403	Introduction to Data Science	CC	4	4

To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.

### **Course Outcomes**

Upon completion of this course, the students should be able to:

CO1: Recognize the various disciplines that contribute to a successful data science effort.

CO2: Explore the fundamental concepts of data science

CO3: Understand data analysis techniques for applications handling large data

CO4: Understand various machine learning algorithms used in data science process

CO5: Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

### **UNIT I: Introduction**

**12Hours**

Benefits and uses of data science and Big data - facets of data : Structured data - Unstructured data- Natural language – Machine generated data – Graph based or Network data - Audio, image, and video - Streaming data - The big data ecosystem and data science.

### **UNIT II: Data Science Process**

**12Hours**

Overview - Defining research goals and creating a project charter - Retrieving data - Cleansing, integrating, and transforming data - Exploratory data analysis - Build the models - Presenting findings and building applications on top of them.

### **UNIT III: Handling Large Data On A Single Computer**

**12Hours**

General techniques for handling large volumes of data - General programming tips for dealing with large data sets - Case study 1: Predicting malicious urls - Case study 2: Building a recommender system inside a database.

### **UNIT IV: Machine Learning**

**12Hours**

What is machine learning and why should you care about it? - The modeling process - Types of machine learning - Unsupervised learning algorithms.

### **UNIT V: Deep Learning**

**12Hours**

Introduction – Model Components- Architectures: Multi Layer Perceptrons – Convolutional Networks– Applications: Prediction - Synthesis.

## Learning Resources

### Text Books

1. “Introducing Data Science”, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st Edition, 2016.
2. “The Little Book of Deep Learning”, François Fleuret, Universite de geneve, <https://fleuret.org/public/lbdl.pdf>.

### Reference Books

1. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016.
2. John D. Kelleher and Brendan Tierney, “Data Science”, First Edition, The MIT Press, London, 2018.
3. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O’ Reilly, 1st edition, 2018

### Websites/ e-Learning Resources

1. <http://csed.sggs.ac.in/csed/sites/default/files/WEKA%20Explorer%20Tutorial.pdf>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	2	2	3	2	2	1	1	1
CO2	3	2	2	3	3	2	2	1	1	1
CO3	3	3	2	2	2	2	2	1	1	1
CO4	3	2	2	2	3	2	2	1	1	1
CO5	3	3	3	2	2	3	2	1	1	1
Average	3	2.4	2.2	2.2	2.6	2.2	2	1	1	1

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24 BDS1405	Relational Database Management System Lab	CC	8	4

The aim of this course is to train the students to create database using SQL for real time application.

### Course Outcomes:

Upon completion of this course, the students should be able to:

CO1: Develop database using SQL.

CO2: Examine queries in SQL to retrieve any type of information from a data base

CO3: Classify various functions available in DML commands

CO4: Construct queries using DCL commands

CO5: Build procedure using join operations

### Lab Components:

1. Creating database tables and using Data Types. Create Table, Modify Table, Drop Table.
2. Practical Based on Data Manipulation.
3. Adding data with Insert, Modify data with Update, Deleting records with Delete.
4. Practical Based on Implementing the Constraints.
5. NULL and NOT NULL, Primary Key and Foreign Key Constraint, Unique, Check and Default Constraint.
6. Practical for Retrieving Data Using following clauses.
7. Simple select clause, Accessing specific data with Where, Ordered By, Distinct and Group By.
8. Practical Based on Aggregate Functions. AVG, COUNT, MAX, MIN, SUM.
9. Practical Based on implementing all String functions.
10. Practical Based on implementing Date and Time Functions.
11. Practical Based on implementing use of union, intersection, set difference.
12. Implement Nested Queries.
13. Implement JOIN operation.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	2	2	3	2	2	1	1	1
CO2	3	2	2	3	3	2	2	1	1	1
CO3	3	3	2	2	2	2	2	1	1	1
CO4	3	2	2	2	3	2	2	1	1	1
CO5	3	3	3	2	2	3	2	1	1	1
<b>Average</b>	<b>3</b>	<b>2.4</b>	<b>2.2</b>	<b>2.2</b>	<b>2.6</b>	<b>2.2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24 BDS1611	Internship – I	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS1402	Cloud Computing	CC	4	4

To make the students to explore the abundant data repositories available for developing intelligence and knowledge based systems.

### Course Outcomes

At the end of the course, students will be able to

CO1: Understand Real time cloud Architecture and their services

CO2: Explain How to setup the cloud environment for various applications

CO3: Analyze How the IoT based Hardware can be connected to the real time cloud services.

CO4: Illustrate various real time applications of IoT

CO5: Articulate the integration of things with cloud

### UNIT I: Introduction to Cloud

**12Hours**

Virtualization concepts, Types of Virtualization & its benefits, Introduction to Various Virtualization OS, HA/DR using Virtualization, Moving VMs, Cloud Fundamentals, Cloud Building Blocks, Understanding Public & Private cloud environments, Private Cloud Environment, Public Cloud Environment, Managing Hybrid Cloud environment.

### UNIT II : The Cloud Setup

**12Hours**

Setting up your own Cloud: Build private cloud using open source tools, Understanding various cloud plugins, Setting up your own cloud environment, Auto-provisioning, Custom images, Integrating tools like Nagios, Integration of Public and Private cloud. Micro services using Docker

### UNIT III: IoT and the Cloud

**12Hours**

Introduction to cloud computing, Difference between Cloud Computing and IoT, Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT. Living on the Edge, An Abstract Edge Architecture Model, Connecting devices at the edge and to the cloud

### UNIT IV: Connecting Things to Cloud

**12Hours**

Various Real time applications of IoT, Connecting IoT to cloud, Cloud Storage for Iot. Cloud-to-Device Connectivity, Device Ingress/Egress, Data Normalization and Protocol Translation, Infrastructure, APIs, The Topology of the Cloud

## UNIT V: Challenge in Integration of Things with Cloud

12Hours

Security, Scalability, Reliability, Performance, Mobility, Resource Optimization & cost efficiency, Cloud data management, cloud data monitoring, Cloud data Exchange, Infrastructure Configuration & reconfiguration, IoT Overarching Challenges

### Learning Resources

#### Text Books

1. Biron, J., & Follett, J. (2016). Foundational elements of an iot solution. O'Reilly Media, Incorporated
2. “Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). (2010). Cloud computing: Principles and paradigms (Vol. 87). John Wiley & Sons.

#### Reference Books

1. “Hwang, K., Dongarra, J., & Fox, G. C. (2013). Distributed and cloud computing: from parallel processing to the internet of things. Morgan kaufmann.

#### Websites/ e-Learning Resources

1. [www.simplilearn.com](http://www.simplilearn.com)
2. [www.spiceworks.com](http://www.spiceworks.com)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	1	2	3	2	1	2	1	3
CO2	3	2	2	1	3	3	2	2	2	3
CO3	3	2	2	2	3	2	2	2	2	3
CO4	3	3	2	3	3	3	2	2	2	3
CO5	3	3	3	3	2	2	2	2	2	3
Average	3	2.6	2	2.2	2.8	2.4	1.8	2	1.8	3

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS1404	Programming in Java	CC	4	4

This course enables the students to learn program and programming skills in JAVA. It covers basic syntax, Operators, Decision making, Branching, Arrays, Classes, Methods and Constructors. To create a program, this also includes Connectivity

### Course Outcomes

Upon completion of this course, the students should be able to:

CO 1: Describe the core syntax and semantics of Java with OOP concepts

CO 2: Determine Java Decision making and Branching ideas

CO 3: Gain knowledge about Classes, Methods and Objects

CO 4: Create and learn how to use AWT and Applet

CO 5: Express the Connectivity using JDBC

### UNIT 1: INTRODUCTION

**12Hours**

Fundamentals of Object Oriented Programming – java Evolution – Java features, Java Program Structure, Java Virtual Machine, Command Line Arguments, Type Casting – Data Types, Variables, Arrays – Operators – Control Statements.

### UNIT II: CLASSES & METHODS

**12Hours**

Introduction to classes – class fundamentals – Declaring objects – constructors – methods overloading methods – method overriding - finalize () method, Static Members, Final Variables and Methods, Final Classes, Abstract Methods and Classes – inheritance — packages - interfaces.

### UNIT III: EXCEPTION HANDLING & MULTITHREADING

**12Hours**

Limitations of Error handling – Advantages of Exception Handling - Types of Errors– Basics of Exception Handling – try blocks – throwing an exception – catching an exception– finally statement.

Creating Threads – Life of a Thread – Defining & Running Thread – Thread Methods– Thread Priority – Synchronization –Implementing Runnable interface – Thread Scheduling.

### UNIT IV: I/O, APPLLET, AWT

**12Hours**

File – Streams – Advantages - The stream classes – Byte streams –Character streams. Introduction – Applet Life cycle – Creating & Executing an Applet –Applet tags in HTML – Parameter tag – Aligning the display.

Drawing and filling lines – Rectangles – Polygon – Circles – Arcs – Line Graphs – Drawing Bar charts AWT Components and Even Handlers: Abstract window tool kit – Event Handlers – Event Listeners – AWT Controls and Event Handling: Labels – Text Component– Action Event – Buttons – Check Boxes – Item Event – Choice– Scrollbars – Layout Managers- Input Events – Menus.

## UNIT -V: INTERACTING WITH DATABASE

**12Hours**

Introduction to JDBC, Essential JDBC classes, Connecting to database, Inserting data in database, Retrieving data from database, deleting data in database, updating data in database, store image in the database, to retrieve image from database, to store file in database, retrieve file from database

### Learning Resources

#### Text Books

3. Balagurusamy, “Programming with Java”, TataMc-Graw Hill, 5th Edition.
4. Sagayaraj, Denis, Karthick and Gajalakshmi, “Java Programming for Core and advanced learners”, Universities Press (INDIA) Private Limited 2018.

#### Reference Books

1. Herbert Schildt, “The complete reference Java”, TataMc-Graw Hill, 7th Edition.

#### Websites/ e-Learning Resources

1. NPTEL & MOOC courses titled Java <https://nptel.ac.in/courses/106105191/>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
<b>CO1</b>	3	3	3	3	1	2	2	1	1	3
<b>CO2</b>	3	3	3	3	1	2	2	1	1	2
<b>CO3</b>	3	2	3	3	2	2	2	1	2	2
<b>CO4</b>	3	2	3	3	2	2	2	1	2	2
<b>CO5</b>	3	2	3	3	2	2	2	1	2	2
<b>Average</b>	<b>3</b>	<b>2.4</b>	<b>3</b>	<b>3</b>	<b>1.6</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.6</b>	<b>2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24 BDS1406	Programming in Java Lab	CC	8	4

The objective of the course is to provide exposure on the concepts of core java and to design and develop applications using different Java programming language techniques. It aims to equip the students to organize and manipulate the data with the help of fundamental data structures and write servlet programs.

### Course Outcomes:

Upon completion of this course, the students should be able to:

CO 1: Identify and explain the ways of solving the simple problems

CO 2: Use appropriate software development environment to write, compile & execute Java programs

CO 3: Analyze and identify necessary mechanisms of Java needed to solve real-world problem

CO 4: Test for defects and validate a Java program with different inputs.

CO 5: Design, develop and compile Core Java, JDBC and servlet applications.

### Lab Components:

1. Programs using constructor and destructor.
2. Creation of classes and use of different types of functions.
3. Count the number of objects created for a class using static member function.
4. Write programs on interfaces.
5. Write programs on packages.
6. Write programs using function overloading and overriding.
7. Programs using inheritance.
8. Programs using IO streams.
9. Programs using files.
10. Write a program using exception handling mechanism.
11. Programs using AWT.
12. Programs on Swing.
13. Programs using JDBC.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	3	2	2	2	1	1	3
CO2	3	3	3	3	2	2	2	1	1	2
CO3	3	2	3	3	2	2	2	1	1	2
CO4	3	2	3	3	2	2	2	1	1	2
CO5	3	2	3	3	2	2	2	1	1	2
<b>Average</b>	<b>3</b>	<b>2.4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24 BDS1622	Internship – II	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24 BDS2401	Artificial Intelligence and Machine Learning	CC	4	4

The objective of this course is to provide introduction to the principles and design of machine learning algorithms. The course is aimed at providing foundations for conceptual aspects of machine learning algorithms along with their applications to solve real world problems.

### Course Outcomes

Upon completion of this course, the students should be able to:

CO1: Identify various machine learning algorithms and terminologies and perform data pre-processing using standard ML library.

CO2: Design a predictive model using appropriate supervised learning algorithms to solve any given problem.

CO3: Develop an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction.

CO4: Solve complex problems using artificial neural networks and kernel machines.

CO5: Implement probabilistic graphical models for suitable applications.

### UNIT-I INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 12Hours

Fundamentals Of Neural Networks – Model of Artificial Neuron – Neural Network Architectures – Learning Methods – Taxonomy Of Neural Network Architectures – Applications.

### UNIT - II FEED FORWARD NEURAL NETWORKS 12Hours

Perceptron Models: Discrete, Continuous and Multi-Category –Training Algorithms: Discrete and Continuous Perceptron Networks – Limitations of the Perceptron – Model. Credit Assignment Problem – Generalized Delta Rule, Derivation of Back propagation (BP) Training, and Summary of Back propagation Algorithm –Kolmogorov Theorem.

### UNIT - III: MACHINE LEARNING 12Hours

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised, Reinforcement- The Machine Learning process. Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets- Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

**UNIT - IV: SUPERVISED LEARNING****12Hours**

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminate Analysis, Logistic Regression- K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression- Ensemble methods.

**UNIT - V: UNSUPERVISED LEARNING****12Hours**

Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality - Dimensionality Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis

**Learning Resources****Text Books**

1. CharuC.Aggarwal “Neural Networks and Deep learning” Springer International Publishing, 2018
2. Satish Kumar, “Neural Networks, A Classroom Approach”, Tata McGraw -Hill, 2007.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009.
4. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson Education, 2018.
5. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2011.

**Reference Books**

1. Andreas C. Muller, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, O'Reilly, 2016.
2. Sebastian Raschka, “Python Machine Learning”, Packt Publishing, 2015.
3. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, 2nd Edition, Springer, 2017.
4. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Revised edition, MIT Press, 2010.

**Websites/ e-Learning Resources**

1. <https://www.javatpoint.com>
2. <https://www.geeksforgeeks.org>

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	3	3	2	2	2	2	1	1	1
<b>CO2</b>	3	2	2	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	3	2	1	1	2	1	1
<b>CO4</b>	3	2	2	2	2	2	1	1	2	1
<b>CO5</b>	3	3	2	2	2	1	2	1	1	1
<b>Average</b>	<b>3</b>	<b>2.6</b>	<b>2.4</b>	<b>2.2</b>	<b>2</b>	<b>1.6</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation –

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS2403	Data Analytics	CC	4	4

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

**Course Outcomes:**

At the end of the course, students will be able to

CO 1: Briefs the basic of Data Analytics

CO 2: Identify the idea of Descriptive Statistics

CO 3: Differentiates the concept of Data Quality and Pre-processing

CO 4: Gain knowledge about Frequent Pattern Matching

CO 5: Understands the different types of Regression types

**UNIT – I: Introduction to Data Analytics** **12Hours**

Big Data and Data Science – Big Data Architecture – Small Data – Taxonomy of Data Analytic – Examples of Data Use – Project on Data Analytics

**Unit – II: Descriptive Statistics** **12Hours**

Scale Types – Descriptive Univariate Analysis – Descriptive Bivariate Analysis – Multivariate Frequencies – Data Visualization

**UNIT – III: Data Quality and Preprocessing** **12Hours**

Data Quality – Converting to different Scale types – Converting to a different Scale – Data Transformation – Dimensionality Reduction

**Unit – IV: Frequent Pattern Matching** **12Hours**

Clustering Validation – Clustering Techniques – Frequent Itemsets – Support and Confidence – Other types of Patterns

**Unit – V: Regression** **12Hours**

Predictive Performance estimation – Finding the parameters of the model – Techniques and model selection – Binary Classification

## Learning Resources

### Text Books

1. João Moreira, Andre Carvalho, Tomás Horvath, “A General Introduction to Data Analytics”, Wiley Publications, 2018
2. S. Christian Albright and Wayne L. Winston, Analytics: “Data Analysis and Decision Making”, Sixth Edition, 2014.
3. John Walkenbach, Michael Alexander, and Richard Kusleika, “Excel 2019 Bible”, John Wiley & Sons, 2019.

### Reference Books

1. Lublinsky, Boris, Kevin T. Smith, and Alexey Yakubovich. Professional hadoop solutions. John Wiley & Sons, 2013.
2. Big Data Analytics, RadhaShankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley
3. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath

### Websites/ e-Learning Resources

1. <https://www.excel-easy.com/data-analysis.html>
2. <https://www.makeuseof.com/tag/data-analysis-excel/>

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0
CO1	3	3	3	3	3	3	2	1	1	1
CO2	3	3	2	2	2	2	1	1	1	1
CO3	3	3	3	3	3	2	2	2	1	1
CO4	3	3	3	2	2	1	1	1	1	1
CO5	3	2	2	2	1	1	2	1	1	1
Average	3	2.8	2.6	2.4	2.2	1.8	1.6	1.2	1	1

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation -

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS2405	Data Analytics using Excel Lab	CC	8	4

The laboratory Exercises includes basic Formulation and Macro in Excel Sheet with various concepts

**Course Outcomes:**

At the end of the course, students will be able to

CO 1: Briefs the basic of Data Analytics using Excel

CO 2: Identify the idea of Descriptive Statistics using Excel

CO 3: Differentiates the concept of Data Quality and Preprocessig using Excel

CO 4: Gain knowledge about Frequent Pattern Matching using Excel

CO 5: Understands the different types of Regression types using Excel

**Lab Components:**

1. Working with format cells – number, accounting, date time and text
2. Design a marks sheet using Font and alignment groups
3. Calculate sum, average, min, max and count number of data
4. Find left, right, middle, upper, lower, and length of a text
5. Summarize student information using pivot table
6. Consolidate four semester student marks
7. Write a program to create employees salary sheet.
8. Write a program to filter out information from worksheet.
9. Write a program to extract information from worksheet.
10. Import external data from text files
11. Predict future values using scenario manager
12. Record a macro to create a new shortcut keys
13. Design a bar chart for student marks
14. Format chart using format plot area, format data series and add trend line

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	2	2	2	2	1	1	1
CO2	3	2	2	2	2	2	1	1	1	1
CO3	3	3	3	3	2	1	1	2	1	1
CO4	3	2	2	2	2	2	1	1	2	1
CO5	3	3	2	2	2	1	2	1	1	1
<b>Average</b>	<b>3</b>	<b>2.6</b>	<b>2.4</b>	<b>2.2</b>	<b>2</b>	<b>1.6</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation -

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24 BDS2633	Internship – III	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS2402	Python Programming	CC	4	4

The course is designed to provide Basic knowledge of Python to students. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language. This course deals with List, Tuple, and Dictionary Concepts.

**Course Outcomes:**

Upon successful completion of the course the students will be able to

CO1: To acquire basic programming skills in core Python

CO2: Brief the idea of Expressions and Operators

CO3: Gain knowledge about Python Functions

CO4: Learn the basic knowledge on Python List and Tuples

CO5: Gives the overview of Dictionary Processing

**UNTI – I: Introduction to Python**

**12Hours**

Introduction to Python – Features of Python – Execution of Python Program – Structure of Python Program – Token – Identifier – Literals – Variables – Data Types - Python Arrays: Defining and Processing Arrays – Array methods.

**Unit –II: Expressions and Operators**

**12Hours**

Expressions – Operators – Types – Decision Control Statements – Looping Statements – Jump Statements

**Unit –III: Functions**

**12Hours**

Introduction to functions – Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement - Difference between Functions and Methods – Categories of Functions – User Defined Functions.

**Unit – IV: List and Tuple**

**12Hours**

Introduction to List – Advantages – Creating a List – Accessing List Elements – Operations and Functions of List – Introduction to Tuple – Creating a Tuple – Accessing a Tuple – Tuple Operations – Functions of Tuple.

**Unit –V: Dictionary Processing**

**12Hours**

Introduction to Dictionary – Advantages of Dictionary – Creating a Dictionary – Accessing Dictionary Elements – Dictionary Operations – Functions and Methods of Dictionary.

## Learning Resources

### Text book:

1. Rydhm Beri, “Python Made Simple: Learn Python programming in easy steps with examples”, BPB Publications, 2019

### Reference Books

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2nd Edition, O ‘Reilly Publishers, 2016.
2. Corey Wade, et al: The Python Workshop, 2nd Edition, Packt, 2022.
3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers, 2018. 4.Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth Edition, 2018.

### Websites/ e-Learning Resources

1. <https://realpython.com>, <http://docs.python.org>,
2. <http://diveintopython.org/>,
3. <https://www.w3schools.com/python/>,
4. <https://www.tutorialspoint.com/python/index.html>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	3	3	2	2	2	-	2	2
CO2	3	2	3	3	2	2	2	1	2	3
CO3	3	2	2	3	2	2	2	1	2	3
CO4	3	2	3	3	2	2	2	-	2	3
CO5	3	2	2	3	2	2	2	1	2	2
<b>Average</b>	<b>3</b>	<b>2</b>	<b>2.6</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2.6</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation -

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS2404	Deep Learning	CC	4	4

The main aim of this course is to provide fundamental knowledge of neural networks and deep learning. On successful completion of the course, students will acquire fundamental knowledge of neural networks and deep learning, such as Basics of neural networks, shallow neural networks, deep neural networks, forward & backward propagation process and build various research projects

**Course outcomes:**

At the end of the course, students will be able to

CO1: Design a simple Neural Networks using Linear Perceptron.

CO2: Implement a Convolution Neural Networks

CO3: Develop an application based on Recurrent Neural Network.

CO4: Solve the Deep Reinforcement Learning problem.

CO5: Build the Speech and Text applications based deep neural network.

**UNIT – I: INTRODUCTION**

**12 Hours**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

**UNIT – II: CONVOLUTIONAL NEURAL NETWORKS**

**12 Hours**

Convolution Operation – ReLU layer – Pooling – Flattening – Full Conversion Layer – Softmax and Cross-Entropy.

**UNIT – III: RECURRENT NEURAL NETWORKS**

**12 Hours**

RNN intuition – Tackling Vanishing Gradient Problem – Long Short-Term Memory – Building a RNN – Evaluating the RNN – Improving the RNN – Tuning the RNN.

**UNIT – IV: BOLTZMANN MACHINES**

**12 Hours**

Introduction to Boltzmann Machine – Energy-Based Models – Restricted Boltzmann Machine – Contrastive Divergence – Deep Belief Networks – Deep Boltzmann Machine.

**UNIT – V: COMPUTER VISION**

**12 Hours**

Viola-Jones Algorithm – Haar-like Features – Integral Image – Training Classifiers – Adaptive Boosting – Cascading – Face Detection with Open CV.

## Learning Resources

### Text Books

1. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly Media, 2017.
2. Li Deng and Dong Yu “Deep Learning Methods and Applications”, Foundations and Trends in Signal Processing, 2013Reference Books
3. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann, Elsevier Publishers, 2013

### Reference Books

1. Ian Goodfellow, “Deep Learning”, MIT Press, 2017.
2. Josh Patterson, “Deep Learning: A Practitioner’s Approach”, PACKT, 2017.
3. Dipayan Dev, “ Deep Learning with Hadoop”, PACKT, 2017.
4. Francois Challo, “ Deep learning with Python”, Manning, 2017.
5. Hugo Larochelle’s Video Lectures.

### Websites/ e-Learning Resources

1. <https://www.oreilly.com/ai/free/files/fundamentals-of-deep-learning-sampler.pdf>
2. <http://link.springer.com/openurl?genre=book&isbn=978-3-319-73004-2>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	1	2	3	2	1	2	1	3
CO2	3	2	2	1	3	3	2	2	2	3
CO3	3	2	2	2	3	2	2	2	2	3
CO4	3	3	2	3	3	3	2	2	2	3
CO5	3	3	3	3	2	2	2	2	2	3
Average	3	2.6	2	2.2	2.8	2.4	1.8	2	1.8	3

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS2406	Python Programming Lab	CC	8	4

To be able to apply appropriately the python programming knowledge gained and develop computer based solutions for a given problem

**Course Outcomes:**

At the end of the course, students will be able to

CO 1: Recall the components of a computer; demonstrate the appropriate use of data types, mathematical functions and strings in a program

CO 2: State the use of selection and looping constructs, compare and choose an appropriate construct for a given problem

CO 3: Develop modular programming using functions, Design program using OO constructs

CO 4: Demonstrate Strings and Lists, implement Lists and Strings appropriately, design new problems using appropriate data structures

CO 5: Demonstrate Tuples, sets, dictionaries and files, compare programs with and without files, develop applications using different data structure

**Lab Components:**

1. Write a Python program to find the average of any five numbers.
2. Write a Python program to find simple interest.
3. Write a Python program to convert Celsius into Fahrenheit temperature.
4. Write a Python program to find Fibonacci series.
5. Write a Python program which accepts the radius of a circle from the user and compute the area.
6. Write a Python program to find the greatest of three numbers.(use only if Statement)
7. Write a Python program to find smallest of three number.(use if and else statement)
8. Write a Python program to check the given no that is even or odd.(use if and else)
9. Write a program in Python to check a number for Armstrong. (while)
10. Write a program in Python to print factorial of a number using recursion.(Function)
11. Finding the sum and average of given numbers using lists.
12. Create a Phone Dictionary. To search a particular person name by giving Phone number.
13. Write a Python Function to display elements of list in reverse order.
14. With a given tuple (1, 2, 3, 4, 5, 6, 7, 8, 9, 10), write a program to print the first half values in one line and the last half values in one line.
15. Write a Python Function to display elements in a Dictionary.

## Learning Resources

### Text Books

1. Y. Daniel Lang, Introduction to Programming using Python, 2nd Edition, Pearson Education Inc., 2013.

### References

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2nd edition, O'Reilly Publishers, 2016.
2. Corey Wade, et al : The Python Workshop, 2nd Edition, Packt, 2022.
3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers, 2018.
4. Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth edition, 2018.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
CO1	3	2	3	3	2	2	2	-	2	2
CO2	3	2	3	3	2	2	2	1	2	3
CO3	3	2	2	3	2	2	2	1	2	3
CO4	3	2	3	3	2	2	2	1	2	3
CO5	3	1	3	3	-	1	2	-	2	2
<b>Average</b>	<b>3</b>	<b>1.8</b>	<b>2.8</b>	<b>3</b>	<b>2</b>	<b>1.8</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2.6</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation –

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24BDS2644	Internship – IV	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3401	R Programming	CC	5	4

This course enables the students to understand the basic of Big data with the help of R Programming concepts.

**Course Outcomes:**

At the end of the course, students will be able to

CO1: Describes the basics of Big Data Analytics

CO2: Understand the basic Formulas and Functions in Data Visualization

CO3: Gain knowledge about Graphical user Interface in R

CO4: Develop Vectors and List of Data Validation in R

CO5: Express the different types of Graphs in R

**UNIT - I: Introduction**

**12 Hours**

Introduction to Big Data Analytics- Overview - State of the Practice in Analytics - Data Analytics Lifecycle – Discovery - Data Preparation - Model Planning

**UNIT - II: Data Collection**

**12 Hours**

Big Data Analytics – Problem definition – Data Collection – Cleansing Data – Summarizing Data – Data Exploration – Data Visualization

**UNIT - III: Introduction to R**

**12 Hours**

Introduction to R- R Graphical User Interface – Features of R – Basic Syntax – data types – variables – Operators - Decision Making – Loops

**Unit IV: Vectors and Matrices**

**12 Hours**

R Vectors – Lists – Matrices – Arrays – Factors – Data Frames, Importing csv files

**UNIT - V: Graphs**

**12 Hours**

Basic Plotting Tools - Plot Function, par Function, Pie Chart, Bar Chart, Box plots, Histograms, Line Graphs, Scatter plots

## Learning Resources

### Text Books

1. Seema Acharya, “Big Data and Analytics”, Wiley India Pvt.Ltc. New Delhi, 2015
2. DT Editorial Services, “Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)”, Dream tech Press edition 2016.
3. Sudha G. Purohit, “Statistics using R”, Narosa publishing House Pvt., Ltd., New Delhi, 2015

### Reference Books

1. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann, Elsevier Publishers, 2013
2. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.

### Websites/ e-Learning Resources

1. [www.tableau.com](http://www.tableau.com)
2. [www.techtarget.com](http://www.techtarget.com)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	2	2	2	3	2	2	2	2
CO2	3	3	2	3	2	3	2	2	3	3
CO3	3	2	3	3	3	3	2	2	2	3
CO4	3	2	3	3	3	2	2	2	3	3
CO5	3	2	3	2	2	2	2	3	3	3
Average	3	2.2	2.6	2.6	2.4	2.6	2	2.2	2.6	2.6

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3403	Data Visualization	CC	5	4

To explore the fundamental concepts, importance of data analysis and design the visualization

**Course Outcomes:**

CO1: Understand foundational visualization concepts

CO2: Demonstrate visualizations principles to enhance data visualization

CO3: Analyze and apply essential design principles to data exploration and visualization

CO4: Design appropriate charts, tables, maps and dashboards

CO5: Effectively create and tell a story based on visualized data

**UNIT - I: VISUALIZATION FUNDAMENTALS**

**12Hours**

Introduction to data visualization-Need for data visualization and its definition-Tools for Visualizing Data-Methods of visualizing data-Overview of modern visualization tools - working with various data formats - Basic chart types.

**UNIT - II: DATA VISUALIZATION FOR HUMAN PERCEPTION**

**12Hours**

The Human Brain and Data Visualization-Cognitive vs Perceptual Design Distinction-Introduction of Effective and Ineffective Visuals-Types of Visualizations and its examples-Practicing Good Ethics in Data Visualization-Ineffective Visuals and improvements-Visual Perception and Cognitive Principles- Strategic Use of Pre-Attentive Attributes - De-Cluttering.

**UNIT - III: EXPLORATORY ANALYSIS**

**12Hours**

Need for exploratory data analysis – Types – EDA Techniques – Tools for performing EDA – Steps for Performing EDA

**UNIT - IV: VISUAL ANALYTICS AND PLANNING**

**12Hours**

Basics of Visual Analytics -Charts- Colours, Shapes, and Sizes-Dual Line Charts-Bar Charts, Line Graphs, Pie Charts-Scatter Plots, Gantt Charts, Bubble Charts-Histograms, Bullet Charts, Heat Maps and Highlight Tables-Dates-Discrete vs. Continuous Dates-Basics of table calculations-Maps. Introduction to Planning and Preproduction for Visualizations: A Design Checklist-understanding Stakeholders-Prioritizing, Optimizing, and Designing.

**UNIT - V: DASHBOARD AND STORY TELLING**

**12Hours**

Dashboard Design Principles - Hierarchies, Actions, Filters, and Parameters-Creating Dashboards. The Story of the data-The Art of Storytelling (Past, Present, and Future)-Storytelling and the Human Brain-Bringing Data to Life-Emotion Modulators-Framing and Format-False Narratives and Data Storytelling-Preparation of the Story Points – Case Study.

## Learning Resources

### Text book:

1. Colin Ware and Kaufman M., Visual thinking for designl, Morgan Kaufmann Publishers,2008 Ben Fry, “Visualizing data”, O’Reily,2007

### Reference Books

1. Chakrabarti, S, —Mining the web: Discovering knowledge from hypertext data ,Morgan Kaufman Publishers, 2003.

### Websites/ e-Learning Resources

1. [www.tableau.com](http://www.tableau.com)
2. [www.techtarget.com](http://www.techtarget.com)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	3	3	3	2	1	1	1
CO2	3	3	2	2	2	2	1	1	1	1
CO3	3	3	3	3	3	2	2	2	1	1
CO4	3	3	3	3	2	1	1	1	1	1
CO5	3	2	2	2	1	1	2	1	1	1
<b>Average</b>	<b>3</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2.2</b>	<b>1.8</b>	<b>1.6</b>	<b>1.2</b>	<b>1</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation -

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3405	R Programming Lab	CC	8	4

This course enables the student to design and develop programs using R Language. It aims to equip the students to organize and manipulate the data with the help of fundamental data structure and write R programs.

#### Course Outcomes:

At the end of the course, students will be able to

**CO1:** Identify and explain the ways of solving the simple problems

**CO2:** Use appropriate software development environment to write, compile & execute R programs

**CO3:** Analyze and identify necessary mechanisms of R needed to solve real-world problem

**CO4:** Test for defects and validate a R program with different inputs.

**CO5:** Design, develop and compile R programs using various tools.

#### Lab Components:

The laboratory Exercises includes basic R Programming with various concepts,

1. Find the Factorial of a Number
2. R Program to display Hello World
3. R Program to Add Two Vectors
4. Take Input From User
5. Check whether a number is prime or not
6. Find Sum, Mean and Product of Vector
7. Write a R program to merge two given lists into one list

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	3	3	2	2	2	1	2	1
CO2	3	2	3	3	2	2	2	1	2	1
CO3	3	2	2	3	2	2	2	1	2	1
CO4	3	2	3	3	2	2	2	1	2	1
CO5	2	2	3	3	2	1	2	1	2	1
<b>Average</b>	<b>2.8</b>	<b>2</b>	<b>2.8</b>	<b>3</b>	<b>2</b>	<b>1.8</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24BDS3655	Internship – V	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3402	Reinforcement Learning	CC	5	4

The aim of this course is to learn the basic concept of Reinforcement Learning and Tabular Solution Methods. It gives an overview of Finite Markov Decision Process, Dynamic programming, Monte Carlo Methods, Planning and Learning

**Course Outcomes:**

At the end of the course, students will be able to

CO1: Describe Reinforcement learning elements and Tabular Solution methods.

CO2: Identify categories of Finite Markov Decision Process

CO3: Analyze the Dynamic Programming methods.

CO4: Solve Problems using Monte Carlo Methods.

CO5: Apply Tabular Method in Planning and Learning

**UNIT I – Introduction**

**12Hours**

Reinforcement Learning – Examples - Elements – Limitations and Scope - An Extended Example: Tic-Tac-Toe - Tabular Solution Methods – An n-Armed Bandit Problem – action value methods – Incremental Implementation – tracking a Nonstationary Problem – Optimistic initial values – associative Search

**UNIT II – Finite Markov Decision Process**

**12Hours**

The Agent – Environment Interface – goals and rewards – unified notation for episodic – Markov Property – Markov decision processes – value function – Optimal value functions – Optimality and Approximation

**UNIT III – Dynamic programming**

**12Hours**

Policy Evaluation – Policy improvement – policy iteration – value iteration – Asynchronous Dynamic programming – Generalized policy iteration – efficiency of Dynamic programming

**UNIT IV - Monte Carlo Methods**

**12Hours**

Monte Carlo Prediction – Estimation of Action values – control – control without Exploring starts – Off Policy prediction – incremental implementation – off policy Montecarlo control – importance sampling on Truncated returns

**UNIT V - Planning and Learning with Tabular Methods**

**12Hours**

Models and Planning – Integrating planning, Acting and Learning – When the model is Wrong – Prioritized sweeping – trajectory Sampling – Heuristic Search – Monte carlo tree search – Hands on using Python.

## Learning Resources

### Text Books

1. Sutton R. S. and Barto A. G., "Reinforcement Learning: An Introduction", MIT Press, 2015

### Reference Books

1. SudharsanRavichandran, "Hands-On Reinforcement Learning with Python", Packt Publishing,2018
2. CsabaSzepesvári, "Algorithms for Reinforcement Learning", Morgan & Claypool Publishers, 2016.
3. Phil Winder, "Reinforcement Learning, O' Reilly, 2020

### Websites/ e-Learning Resources

1. <https://www.javatpoint.com>
2. <https://www.geeksforgeeks.org>

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0
CO1	3	3	3	2	2	2	2	1	2	1
CO2	3	3	2	2	2	2	1	1	1	1
CO3	3	3	3	3	3	2	1	2	1	1
CO4	3	2	3	2	2	2	1	1	1	1
CO5	2	3	2	2	1	1	2	1	1	1
Average	2.8	2.8	2.6	2.2	2	1.8	1.4	1.2	1.2	1

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation - ‘-’

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3404	Data Security	CC	5	4

This course enables the students to learn basic understanding of the various issues related to information systems security. The course will present an overview of the risks encountered in information systems security, and the tools used for resolving these risks.

**Course Outcomes:**

Upon successful completion of the course the students will be able to

CO1: Understand the fundamental principles of Cryptography techniques, authentication

CO2: Brief the idea of Classical Cryptography

CO3: Describe the basic knowledge and working of DES

CO4: Gain knowledge about ethical issues in Computer security.

CO5: Understand and apply principles of data visualization.

**UNIT – I: Introduction to Cryptography**

**12Hours**

Security – Attacks - Computer crime - Security services - Security Mechanisms - Cyber crimes - Information technology ACT - Cryptography - Substitution Cipher – Block and Stream Ciphers

**UNIT – II: Classical Cryptography**

**12Hours**

Confusion – Diffusion - Symmetric Key - Asymmetric Key – Encryption - DES Algorithm - Hash function - Digital Signatures - Digital Certificates

**UNIT – III: Program Security & Protection**

**12Hours**

Program Security - Program errors - Malicious Codes – Virus - Trapdoors Salami Attacks – Threats - Covert Channels - Control Against Program – Program Security issues – Protecting Programs.

Protection in OS: Memory and Address Protection – Access control – File protection User Authentication

**Unit – IV: Database Security**

**12Hours**

Introduction – Requirements – Reliability – Integrity – Sensitive data – Inference – Multilevel Security – Types of Crimes – Ethical issues in security – Protecting data

**Unit – V: Network Security**

**12Hours**

Introduction – Threats in Networks – Security Controls – Firewalls – Intrusion detection systems – Secure e-mails – Administrating Security – Security Planning – Risk analysis – Organizational Security Policy – Physical Security.

## Learning Resources

### Text book:

1. Christof Paar, Jan Pelzl, “Understanding Cryptography: A Textbook for Students and Practitioners”, Springer Publishers, 2009

### Reference book:

1. Data Security in cloud computing : Publisher Institution of Engineering and Technology (31 july 2017)

### Websites/ e-Learning Resources:

1. [www.researchgate.net](http://www.researchgate.net)
2. [i.dell.com](http://i.dell.com)
3. [www.ibm.com](http://www.ibm.com)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0
CO1	3	3	3	2	2	2	2	1	2	1
CO2	3	3	2	2	2	2	1	1	1	1
CO3	3	3	3	3	3	2	1	2	1	1
CO4	3	2	3	2	2	2	1	1	1	1
CO5	2	3	2	2	1	1	2	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.8</b>	<b>2.6</b>	<b>2.2</b>	<b>2</b>	<b>1.8</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation - ‘-’

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24BDS3406	Reinforcement Learning using Python Lab	CC	8	4

To introduce the concepts of Reinforcement Learning and developing a real time applications

### Course Outcomes:

Upon completion of this course, the students should be able to:

CO1: Implement a random policy in a discrete environment

CO2: Create a simple grid world

CO3: Implement a basic Q-learning algorithm

CO4: Implement the value iteration algorithm

CO5: Create a function to visualize the path

### Lab Components:

The laboratory Exercises includes Reinforcement lab using Python

1. Setup OpenAI Gym Environment:

Write a Python script to create and run an OpenAI Gym environment. For example, use `gym.make('CartPole-v1')` to initialize the environment, then reset and render it.

2. Random Policy Implementation:

Implement a random policy in a discrete environment like FrozenLake-v0. Simulate a few episodes and calculate the average reward.

3. Gridworld Simulation:

Create a simple gridworld where an agent can move in four directions. Implement a function to simulate the environment's state transitions and rewards.

4. Basic Q-Value Initialization:

Initialize a Q-value table for a simple environment like Taxi-v3. Populate the table with zeros

5. Implement an epsilon-greedy strategy for selecting actions in a bandit problem. Track the actions taken and rewards received.

6. Simple Policy Evaluation:

Given a fixed policy and a small MDP, implement a function to evaluate the policy by calculating the state value function.

7. Simple Q-Learning:

Implement a basic Q-learning algorithm for the FrozenLake-v1 environment. Use a simple learning loop to update the Q-table.

8. Value Iteration:

Implement the value iteration algorithm to solve a simple MDP and compute the optimal policy

9. Policy Iteration:

Implement policy iteration to find the optimal policy for a given MDP. Use the evaluation and improvement steps iteratively

10. Gridworld Path Visualization:

Create a function to visualize the path taken by an agent in a gridworld, highlighting the start and goal states.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO1 0
CO1	3	3	3	2	2	2	2	1	2	1
CO2	3	3	2	2	2	2	1	1	1	1
CO3	3	3	3	3	3	2	1	2	1	1
CO4	3	2	3	2	2	2	1	1	1	1
CO5	2	3	2	2	1	1	2	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.8</b>	<b>2.6</b>	<b>2.2</b>	<b>2</b>	<b>1.8</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation - ‘-’

<b>Course Code</b>	<b>Name of the Course</b>	<b>Category</b>	<b>Hours/Wk.</b>	<b>Credits</b>
24BDS3666	Internship – VI	CC	-	6

Job Training: A work-based learning experience that enables the student to apply specialized occupational theory, skills and concepts.

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	2	2	2	1	1	1	1
<b>CO2</b>	3	3	3	2	2	2	1	1	1	1
<b>CO3</b>	3	3	3	2	2	2	1	1	1	1
<b>CO4</b>	3	3	2	2	3	2	2	1	1	2
<b>CO5</b>	2	2	2	2	2	1	1	1	1	1
<b>Average</b>	<b>2.8</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>2.2</b>	<b>1.8</b>	<b>1.2</b>	<b>1</b>	<b>1</b>	<b>1.2</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MDV1401	Basic Mathematics	SEC	4	4

This course enables the students to learn Basic Mathematics. It covers set Theory, Logic, Algebra, Matrix, and Series.

### Course Outcomes

Upon completion of this course, the students should be able to:

CO 1: Describe different types of set and Venn Diagram

CO 2: Understand the basic concepts of Mathematical Logic

CO 3: Elucidate the properties of Groups

CO 4: Classify the types of Matrix and solutions of equations by determinants

CO 5: Gain the knowledge about the Sequence and Series

### UNIT – I: Set Theory

**12Hours**

Set and their Representations –Types of Set–Sub Set – Power Set – Venn Diagram – Operation on Set – Applications

### UNIT –II: Mathematical Logic

**12Hours**

Basic Logical Connection – Conjunction – Disjunction – Negation, Conditional and Bi-conditional and its compound Statements –Truth Table – Logical Equivalence – Applications

### UNIT –III: Modern Algebra

**12Hours**

Binary Operation – Group -Addition Modulo  $n$  – Multiplication Modulo  $n$  –Properties of groups – Semigroup– Sub groups

### UNIT –IV: Matrices and Determinants

**12Hours**

Definition – Operations on Matrix – Square Matrix and its Inverse – Determinants – Properties – Solving equations using Determinants.

### UNIT –V: Sequence and Series

**12Hours**

Finite and infinite Sequence– Series of Positive terms – Convergence and divergence — Binomial series –Logarithmic series- Exponential Series

## Learning Resources

### Text Books

1. Serge Lang, “Basic Mathematics”, Springer New York, 1998.

### Reference Books

1. Mike Rosser, “Basic Mathematics for Economists”, Routledge, 2016
2. E. A. Maxwell, “Algebraic Structure and Matrices”, Cambridge University Press, 2009
3. S.Arumugam & A.Thangapandian Issac, Modern algebra, scitech publication,2019.

### Websites/ e-Learning Resources

1. <https://www.javapoint.com/>
2. <https://www.techtarget.com>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	3	3	2	2	1	1	2
CO2	3	3	3	2	3	2	1	1	1	1
CO3	3	2	3	2	2	1	1	2	1	1
CO4	3	3	3	3	3	2	2	1	2	1
CO5	3	2	2	2	2	1	2	1	1	1
Average	3	2.6	2.8	2.4	2.6	1.6	1.6	1.2	1.2	1.2

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MDV2401	Statistics – I	SEC	4	4

The course is designed to provide Basic of Statistics. This course deals with Classification, Tabulation, Presentation of Data, Measures of Central Tendency, Dispersion, Mean and Standard Deviation.

Upon successful completion of the course the students will be able to

CO 1: Understand the important scope of Statistics

CO 2: Brief the idea of Tabulation and classification of data

CO 3: Gain knowledge about Histogram and Polygon

CO 4: Describe the merits and demerits of Median and Mode

CO 5: Compare the classified data and get conclusion

### **UNIT - I: Introduction**

**12Hours**

Introduction to Statistics – Definition – Importance of Statistics –Scope and Applications of Statistics – Limitation – Statistics Software.

### **UNIT - II Classification and Tabulation**

**12Hours**

Introduction – Functions of Classification – Types of Classification– Tabulation –Basic difference between Classes and Tabulation

### **UNIT - III: Presentation of Data**

**12Hours**

Diagram – Graphical Presentation – Histogram – Frequency Polygon – Frequency Curve

### **UNIT - IV: Measures of Central Tendency and Dispersion**

**12Hours**

Introduction – Objective of statistical average – Arithmetic mean —Properties of Arithmetic mean –Median –Mode – Merits and Demerits

### **UNIT - V: Measures of Dispersion**

**12Hours**

Dispersion – Range – Mean Deviation – Standard Deviation – Properties of Standard Deviation – Co-efficient of Variance

## Learning Resources

### Text Books

1. R.S.N. Pillai Bagavathy, “Statistics”, S Chand Publishing 2022.
2. S.Arumugam and A.Thangapandian Issac, “ Statistics”, New Gamma publishing House, 2015

### Reference Books

1. Anderson, Sweeney and Williams, “Statistics for Business and Economics”, South Western Engage Learning, 2013
2. Robert S. Witte, John S. Witte, “Statistics”, John Wiley and Sons, 2013.
3. Dawn Griffiths, “Head first Statistics”, O’Reilly Publications, 2008

### Websites/ e-Learning Resources

1. <https://www.geeksforgeeks.org/>
2. <https://www.math.uci.edu.com>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	2	3	2	2	1	2	1
CO2	3	2	3	2	3	2	2	1	1	1
CO3	3	3	3	3	3	1	2	2	1	1
CO4	3	3	2	2	2	2	1	1	2	1
CO5	3	3	3	2	2	1	2	1	2	2
Average	3	2.8	2.8	2.2	2.6	1.6	1.8	1.2	1.6	1.2

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MDV2402	Statistics - II	SEC	4	4

This course enables the students to understand the basic concept of Probability and Correlation. It enables the concept of Probability, Random Variables, Various Distribution, Correlation and Regression.

Upon successful completion of the course the students will be able to

CO 1: Describes the basics concept of Probability

CO 2: Understand the Probability Mass function

CO 3: Gain knowledge about various Distribution

CO 4: Illustrate the features of Bivariate Distribution

CO 5: Elucidate the types of Correlation and regression

**UNIT – I: Probability Basic Concepts** **12Hours**

Introduction – Sample Space and Events – Axiom Approach – Basic Theorems

**UNIT – II: Random Variable** **12Hours**

Discrete and Continuous random variable Probability Mass Function – Density Function

**Unit – III: Theoretical Distribution** **12Hours**

Distribution- Binomial – Poisson – Normal – Exponential

**UNIT – IV: Bivariate Distribution** **12Hours**

Joint Probability Distribution – Marginal and Conditional Distribution – Conditional Expectation

**UNIT – V: Correlation and Regression** **12Hours**

Introduction to Correlation – Karl Pearson correlation – Spearman’s Rank Correlation – Regression Analysis – Multiple Regression Analysis

**Learning Resources**

**Text Books**

1. S.Arumugam and A.Thangapandian Issac, “ Statistics”, New Gamma publishing House, 2015
2. Saeed Hahramain, “Fundamental of Probability with Stochastic Process”, 2018

### Reference Books

1. Sheldon M. Ross, “Introduction to Probability Models”, Elsevier Publication, 2010
2. R.S.N. Pillai Bagavathy, “Statistics”, S Chand Publishing 2022

### Websites/ e-Learning Resources

1. <https://www.geeksforgeeks.org/>
2. <https://www.math.uci.edu.com>

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	2	3	3	3	2	2	2	2	2
<b>CO2</b>	3	3	2	2	2	2	2	1	1	1
<b>CO3</b>	3	2	2	1	3	1	2	1	2	1
<b>CO4</b>	3	2	2	1	2	2	1	1	1	1
<b>CO5</b>	3	2	3	2	3	1	2	2	2	2
<b>Average</b>	<b>2.8</b>	<b>2.2</b>	<b>2.4</b>	<b>1.8</b>	<b>2.6</b>	<b>1.6</b>	<b>1.8</b>	<b>1.4</b>	<b>1.6</b>	<b>1.4</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation-

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MDV3401	Linear Algebra	SEC	4	4

This course enables the students to learn basics of Algebra. It covers basic knowledge on Linear Equation, Vector Space, Inner product space, Linear Transformations and Eigen Value vectors.

**Course Outcomes:**

Upon successful completion of the course the students will be able to

CO 1: Gives the basic knowledge on Linear Equation

CO 2: Brief the idea of Column space and Row Space

CO 3: Elucidate the Orthogonal and angle between the vectors

CO 4: Gain knowledge about Linear Transformation

CO 5: Discuss the various concepts of Eigen Value and Eigen Vector

**UNIT – I: System of Linear Equations and Matrices**

**12Hours**

System of Linear Equations – Gauss Estimation Elementary Matrices – Method of Finding Inverse of Matrices

**UNIT - II: Vector Spaces**

**12Hours**

Vector Spaces and Subspaces – Linear Combinations – Linear Independence and Dependences – Null space – Column Space – Row Space – Dimension of Vector Space

**UNIT - III: Inner Product Space**

**12Hours**

Inner Product – Length – Angle and Orthogonality – Orthogonal Set –Decomposition

**UNIT – IV Linear Transformation**

**12Hours**

Introduction – General Linear Transformation – Kernel and Range – Matrices of General Linear Transformation

**UNIT – V Eigen Value and Eigen Vector**

**12Hours**

Introduction to Eigen Values– Eigen Vectors – Diagonalizing a Matrix — Positive Definition Matrix – Quadratic Forms

## Learning Resources

### Text Books

1. Howard Anton, Chris Rorres, “Elementary Linear Algebra”, Wiley Publication, 2019.

### Reference Books

1. David C. Lay, “Linear Algebra and Applications”, Pearson Publication, 2016
2. Steven J. Leon, “Linear Algebra with Applications”, Macmillan Publication, 1990
3. S.Arumugam & A.Thangapandian Issac, Modern algebra, scitech publication,2019.

### Websites/ e-Learning Resources

1. <https://www.geeksforgeeks.org/>
2. <https://www.math.uci.edu.com>

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>CO1</b>	3	3	3	3	3	2	2	2	1	1
<b>CO2</b>	3	2	3	2	3	2	1	1	1	1
<b>CO3</b>	3	3	3	3	2	1	1	2	1	1
<b>CO4</b>	3	2	3	2	3	2	2	1	2	1
<b>CO5</b>	3	3	2	2	3	1	2	1	1	1
<b>Average</b>	<b>3</b>	<b>2.6</b>	<b>2.8</b>	<b>2.4</b>	<b>2.8</b>	<b>1.6</b>	<b>1.6</b>	<b>1.4</b>	<b>1.2</b>	<b>1</b>

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24MDV3402	Graph Theory	SEC	4	4

This course enables the students to understand the basic of Graph Theory. It enables the basic graph concept of Graph, Classes of Graph, Introduction of Tree, Connectivity and Advanced Graphs.

Upon successful completion of the course the students will be able to

CO 1: Describes the basic definitions of the Graph theory

CO 2: Understand the basic properties of Graph

CO 3: Gain knowledge about Spanning Tree

CO 4: Develop the relation between Vertex and Edge

CO 5: Express the different between Eulerian and Hamiltonian Graph

### **UNIT – I: Basic Graph Concept**

**12Hours**

Graphs – Directed and Undirected – Sub graphs – Graph Models – Degree of Vertex – Isomorphic graphs – Adjacency and Incidency matrices

### **UNIT – II: Common Classes of Graph**

**12Hours**

Regular – connected – Complete Peterson – Cycle – Path– Walk- Trail – K-Partite – Planar – Hypercube

### **UNIT – III: Tree**

**12Hours**

Properties of Tree – Spanning tree –Kirchhoff’s Matrix Tree Theorem – Graph Decomposition

### **UNIT – IV: Connectivity**

**12Hours**

Vertex and Edge Connectivity – Vertex and Edge Cuts – Relationship between vertex and Edges – Bounds for Connectivity

### **UNIT – V: Eulerian and Hamiltonian Graph**

**12Hours**

Eulerian graph – Route Inspection Problems – Hamiltonian Graph – Gray Code

## Learning Resources

### Text Books

1. S.A.Choudum, “A first course in Graph Theory”, trinity press, 2020
2. S.Arumugam & S,Ramachandran, “Invitation to graph theory”, scitech publication,2019
3. Douglas B West, “Graph Theory”, Pearson Publication, 2017

### Reference Books

1. Bondy JA and Murty, “Graph Theory”, Macmillan Publication, 1977
2. Bela Bollabas, “Random Graph”, Cambridge University Press, 2004

### Websites/ e-Learning Resources

1. <https://www.geeksforgeeks.org/>
2. <https://www.math.uci.edu.com>

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	3	3	3	2	2	1	2	1
CO2	3	3	3	2	3	2	1	1	1	1
CO3	3	3	3	2	3	1	1	2	2	1
CO4	3	2	2	2	2	2	1	1	1	1
CO5	2	2	2	2	2	1	2	1	2	1
Average	2.8	2.4	2.6	2.2	2.6	1.6	1.4	1.2	1.6	1

High correlation – 3, Medium Correlation – 2, Low correlation – 1, No correlation