(Formerly University of Pune)

Bachelors Degree in Data Science

(Faculty of Science and Technology)



Syllabi for B.Sc. (Data Science)

(For Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System (CBCS) Syllabus Under National Education Policy (NEP)

To be implemented from Academic Year 2024-2025

Preamble

Welcome to the B.Sc.(Data Science) programme! This programme is designed to empower students with knowledge and skills required to thrive in an era of data science and technology. By choosing B.Sc. (Data Science) Programme, students enter into the dynamic field of data science and data analytics. Students will engage and build strong foundation in mathematics, statistics, computer science and ethical data practices. This programme not only equips students with technical expertise but also fosters a mindset of continuous learning, adaptability and ethical leadership.

As you navigate this syllabus, consider it a roadmap to your future in data science. Welcome to the world where data becomes insight and insight drives innovation.

Eligibility

- (a) Higher Secondary School Certificate (HSC) (10+2) with any stream or its equivalent examination having Mathematics/ Statistics/ Information Technology(IT) at 10+2 level.
 Note: If candidates having Information Technology (IT) at 10+2 level and not offered Mathematics/Statistics as one of the subject then such candidates should have to complete the Bridge Course (Specified in the syllabus) before completion of semester-I.
 - OR
- (b) Three Years Diploma Course after S.S.C. (10th standard) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Programme Outcomes:

- PO 1: The programme seeks to develop strong foundation in Mathematics, Statistics and Computer Science that demonstrate proficiency in basic programming languages and tools.
- PO 2: The programme aims to understand the principles of data storage and retrieval by acquiring knowledge of data type structures and basic data manipulation techniques.
- PO 3: The programme helps to learn database management techniques with design and management of databases as well as executing SQL queries for data retrieval and manipulation.
- PO 4: By applying advanced statistical methods and machine learning techniques, the students can analyze complex datasets, interpret and communicate findings effectively.
- PO 5: The programme also aims to understand and work with big data technologies and apply these technologies to process and analyze large-scale datasets.
- PO 6: The students can create clear and effective data visualizations using various tools and communicate complex findings through visual representations.

- PO 7: The programme also seeks to develop comprehensive projects by applying data science techniques to solve real-world problems that will improve the ability of learner to integrate knowledge and skills acquired throughout the programme.
- PO 8: Through hands-on projects, practical assignments, and exposure to state-of-the-art tools and technologies, programme aim to develop the technical proficiency and problem-solving skills necessary for success in the professional world.
- PO 9: Depending on the chosen track, students can develop expertise in data analytics with areas such as Business, Social Media, HR, Financial, Healthcare, Supply Chain & Logistics and Big Data etc.
- PO 10: The program include On Job Training, internships and research work that provides learners with practical experience, applying their knowledge to real-world challenges.
- PO 11: Graduates will be adept at presenting complex technical concepts clearly and effectively, both in written and oral forms, to various audiences.
- PO 12: The programme places a strong emphasis on ethical considerations, responsible use of technology, and awareness of the societal impact of data science and computing solutions.
- PO 13: The programme aim to produce graduates who approach their work with integrity and a sense of social responsibility.
- PO 14: Acknowledging the dynamic nature of computer science, the programme aim to inspire students for continuous learning and professional development, empowering them to adapt and thrive in the face of technological advancements; prepared them to adapt to new technologies and methodologies throughout their careers.
- PO 15: The students will be encouraged to think creatively and innovatively, exploring new ideas and approaches to solve data science related problems and advance the state of the art in the field.

Bridge Course : Foundation of Mathematics and Statistics for Data Science

(This course is to be offered only by students having Information Technology (IT) at 10+2 level and not offered Mathematics/Statistics as one of the subject. Note that this Bridge Course must be completed by students before completion of semester-I)

No. of C	credits: 2	Teaching Scheme	Examinatio	on Scheme	
		Theory:2 Hrs /Week	Continuous	Internal Eval	luation:50 Marks
Objectiv	ve :				
To learn	and understand	the fundamental concept	s of Mathema	atics and Stat	tistics required for
Data Sci	ence				
Course	Outcomes				
On Com	pletion of this cou	rse, student will be able	to –		
CO1: Ur	nderstand concepts	s of determinants and ma	trices		
CO2: Le	arn fundamental 1	neasures of dispersion an	nd probability		
		rmutations and combinat	ions		
CO4: Ur	nderstand working	of sets and relations			
CO5: Co	onstruct equations	of line, vector and plane			
	Γ				1
Unit		Name of Unit		Teaching	CO Targeted
No.				Hours	
1	Determinants a			8	CO1
	value of determin				
		3 and expansion of deter			
		of elements of determinat	nts		
		es, Types of matrices			
-		equality, multiplication	by scalar, add	lition and mu	iltiplication of two
	ices, transpose of			_	
2		spersion and Probabilit	-	5	CO2
	_	n – Range, Variance, Sta			
		Conditional probability,	Baye's Theor		000
3		nd Combinations		5	CO3
	orial Notation				
3.2 Perm					
3.3 Com	1			-	
4	Sets and Relation			6	CO4
		epresentation of sets			
• -	es of sets, operatio				
	duction to relation			-	
5	Line, Vector an	d Plane		6	CO5

- 5.1 Locus, Straight line, Equation of line in standard form
- 5.2 Representation of vectors, Types of vectors, Algebra of vectors

5.3 Introduction to plane, Equation of plane

Reference Books

- 1. Mathematics and Statistics (Arts and Science), Standard XI, Part-I and II
- 2. Mathematics and Statistics (Arts and Science), Standard XII, Part-I and II
- By Maharashtra State Board of Text Book Production and Curriculum Research, Pune

Evaluation Scheme

- The evaluation of this bridge course will be at college level for 50 marks.
- Evaluation records are to be maintained by the college itself.

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

FY (Level 4.5) SEMESTER I

Course Type	Course code	Course Name	Cre		Sch Hrs/	ching eme Week	So	xamina cheme Mark	and s
			TH	PR	TH	PR	CE	EE	Total
Subject-	DS-101-T	Problem Solving and Python Programming	2	-	2	-	15	35	50
1	DS-102-P	Lab Course on DS-101-T (Python Programming)	-	2	-	4	15	35	50
Subject-	DS-103-T	Descriptive Statistics	2	-	2	-	15	35	50
2	DS-104-P	Lab Course on DS-103-T (Descriptive Statistics)	-	2	-	4	15	35	50
Subject-	DS-105-T	Computational Mathematics	2	-	2	-	15	35	50
3	DS-106-P	Lab Course on DS-105-T (Computational Mathematics)	-	2	-	4	15	35	50
GE/OE *	OE-101-DS-T* OE-102-DS-T* OE-103-DS-T* OE-104-DS-T*	 Office Automation I/ Introduction to Computers and Basics of Internet / Introduction to Google Apps I/ Fundamentals of Computers I 	2	-	2	-	15	35	50
SEC	SEC-101-DS-T	Computer Organization	2	-	2	-	15	35	50
IKS	IKS-100-T	Generic IKS	2	-	2	-	15	35	50
AEC	AEC-101-ENG	English	2	-	2	-	15	35	50
VEC	VEC-101- ENV	EVS-I	2	-	2	-	15	35	50
		Total	16	6	16	12			550

* These subjects are offered to other faculty students under GE/OE vertical. The students of B.Sc. (Data Science) will opt the subjects offered by other faculty given in University Basket.

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

FY (Level 4.5) SEMESTER II

Course Type	Course code	Course Name	Cre	dits	Sch	ching eme Week		kamina cheme Mark	and
			ТН	PR	TH	PR	CE	EE	Total
Subject-	DS-151-T	Advanced Python Programming	2	-	2	-	15	35	50
1	DS-152-P	Lab Course on DS-151-T (Advanced Python Programming)	-	2	-	4	15	35	50
Subject	DS-153-T	Discrete Probability and Probability Distributions	2	-	2	-	15	35	50
Subject- 2	DS-154-P	Lab Course on DS-153-T (Discrete Probability and Probability Distributions)	-	2	-	4	15	35	50
Subject-	DS-155-T	Graph Theory	2	-	2	-	15	35	50
3	DS-156-P	Lab Course on DS-155-T (Graph Theory)	-	2	-	4	15	35	50
GE/OE *	OE-151-DS-T* OE-152-DS-T* OE-153-DS-T* OE-154-DS-T* OE-155-DS-T* OE-156-DS-T*	 Office Automation II/ Computer Fundamentals / Introduction to Google Apps II/ Fundamentals of Computers II/ Introduction to Data Science/ AI Tools for Business 	2	-	2	-	15	35	50
SEC	SEC-151-DS-P	Lab Course on Excel and Advanced Excel	-	2	-	4	15	35	50
AEC	AEC-151-ENG	English	2	-	2	-	15	35	50
VEC	VEC-151- ENV	EVS-II	2	-	2	-	15	35	50
СС	CC-151-T	From University Basket	2	-	2	-	15	35	50
	•	Total	14	8	14	16			550

* These subjects are offered to other faculty students under GE/OE vertical. The students of B.Sc. (Data Science) will opt the subjects offered by other faculty given in University Basket.

Exit option: Award of UG Certification in B.Sc. (Data Science) with 44 credits and an additional 04 credits as per University guidelines or else continue with Major and Minor.

Continue option: In second year Data Science will be the Major and Statistics as a Minor subject.

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

SY (Level 5.0) SEMESTER III

Course Type	Course code	Course Name	Cro TH	edits PR	Teach Sche Hrs/V TH	eme		kamin cheme Mar E E	
	DS-201-MJ-T	Database Management System	2	_	2	_	Е 15	Е 35	50
Major	DS-202-MJ-T	Data Structure-I	2	-	2	-	15	35	50
Core	DS-203-MJ-P	Lab Course on DS-201-MJ-T and DS-202-MJ-T	-	2	-	4	15	35	50
VSC	DS-221-VSC-T	Foundations of Data Science	2	-	2	-	15	35	50
FP/ OJT/ CEP	DS-231-FP	Mini Project	-	2	-	4	15	35	50
Minor	DS-241-MN-T	Probability Distribution and Modelling	2	-	2	-	15	35	50
	DS-242-MN-P	Lab Course on DS-241-MN-T	-	2	-	4	15	35	50
GE/OE *	OE-201-DS-T* OE-202-DS-T* OE-203-DS-T* OE-204-DS-T*	 E commerce-I / Web Design-I/ Digital Marketing-I/ AI for Everyone-I 	2	-	2	-	15	35	50
IKS	DS-200-IKS	Indian Knowledge System in Computing	2	-	2	-	15	35	50
AEC	AEC-201-T	From University Basket	2	-	2	-	15	35	50
CC	СС-201-Т	From University Basket	2	-	2	-	15	35	50
		Total	16	6	16	12			550

* These subjects are offered to other faculty students under GE/OE vertical. The students of B.Sc. (Data Science) will opt the subjects offered by other faculty given in University Basket.

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

SY (Level 5.0) SEMESTER IV

Course Type	Course code	Course Name	Credits		Credits		Sch	ching eme Week		kamin chemo Mar	
			TH	PR	TH	PR	C E	E E	Total		
	DS-251-MJ-T	Relational Database Management System	2	-	2	-	15	35	50		
Major Core	DS-252-MJ-T	Data Structure-II	2	-	2	-	15	35	50		
core	DS-253-MJ-P	Lab Course on DS-251-MJ-T and DS-252-MJ-T	-	2	-	4	15	35	50		
VSC	DS-271-VSC-P	Data Analytics	-	2	-	4	15	35	50		
FP/ OJT/ CEP	DS-281-FP	Mini Project	-	2	-	4	15	35	50		
Minor	DS-291-MN-T	Testing of Hypothesis and Sampling Distributions	2	-	2	-	15	35	50		
	DS-292-MN-P	Lab Course on DS-291-MN-T	-	2	-	4	15	35	50		
GE/OE *	OE-251-DS-T* OE-252-DS-T* OE-253-DS-T* OE-254-DS-T*	 E commerce-II / Web Design-II / Digital Marketing-II/ AI for Everyone-II 	2	-	2	-	15	35	50		
SEC	SEC-251-DS-T	Software Engineering	2	-	2	-	15	35	50		
AEC	AEC-251-T	From University Basket	2	-	2	-	15	35	50		
СС	CC-251-T	From University Basket	2	-	2	-	15	35	50		
	•	Total	14	8	14	16			550		

* These subjects are offered to other faculty students under GE/OE vertical. The students of B.Sc. (Data Science) will opt the subjects offered by other faculty given in University Basket.

Exit option: Award of UG Diploma in B.Sc. (Data Science) with 88 credits and an additional 04 credits as per University guidelines or else continue with Major and Minor.

Continue option: Third year will be continued with Data Science as Major and Statistics as a Minor subject.

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

TY (Level 5.5) SEMESTER V

Course Type	Course code	Course Name	Cro	edits	Sch	ching neme Week	Examination Scheme and Marks		
			TH	PR	ТН	PR	C E	E E	Total
	DS-301-MJ-T	NoSQL databases	4	-	4	-	30	70	100
	DS-302-MJ-T	R Programming	2	-	2	-	15	35	50
Major Core	DS-303-MJ-T	Foundations of Artificial Intelligence	2	-	2	-	15	35	50
Core	DS-304-MJ-P	Lab Course on DS-301-MJ-T (NoSQL databases)	-	2	-	4	15	35	50
	DS-305-MJ-P	Lab Course on DS-302-MJ-T (R Programming)	-	2	-	4	15	35	50
	DS-310-MJ-T	Business Analytics	2	-	2	-	15	35	50
Major	DS-311-MJ-P	Lab Course	-	2	-	4	15	35	50
Elective	OR					-			
	DS-312-MJ-T	Social Media Analytics	2	-	2	-	15	35	50
	DS-313-MJ-P	Lab Course	-	2	-	4	15	35	50
VSC	DS-321-VSC-P	Lab Course on MATLAB	-	2	-	4	15	35	50
FP/CEP	DS-331-FP	Project	-	2	-	4	15	35	50
Minor	DS-341-MN-T	Categorical and Multivariate Data Analysis	2	-	2	-	15	35	50
				40	10	• •			
		Total	12	10	12	20			550

Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

TY (Level 5.5) SEMESTER VI

Course Type	Course code	Course Name	Cre	edits	Sch	ching eme Week		amina heme Marl	and
			T H	PR	TH	PR	CE	E E	Total
	DS-351-MJ-T	Data Visualization and Modelling	4	-	4	-	30	70	100
Major	DS-352-MJ-T	Artificial Intelligence in Data Science	2	-	2	-	15	35	50
Core	DS-353-MJ-T	Data Security and Privacy	2	-	2	-	15	35	50
	DS-354-MJ-P	Lab on DS-351-MJ-T	-	2	-	4	15	35	50
	DS-355-MJ-P	Lab Course on DS-352-MJ-T	-	2	-	4	15	35	50
	DS-360-MJ-T	HR Analytics	2	-	2	-	15	35	50
	DS-361-MJ-P	Lab Course	-	2	-	4	15	35	50
Major Elective	OR								
Elective	DS-362-MJ-T	Financial Analytics	2	-	2	-	15	35	50
	DS-363-MJ-P	Lab Course	-	2	-	4	15	35	50
VSC	DS-371-VSC-P	Advance Data Science Tools	-	2	-	4	15	35	50
OJT	DS-381-OJT	On Job Training	-	4	-	8	30	70	100
		Total	10	12	10	24			550

Exit option: Award of Bachelor of Data Science (B.Sc. Data Science) with Statistics as a minor with 132 credits or else continue.

Continue option: Fourth year will be continued for B.Sc.(Data Science) Honors with Research.

Syllabus Structure as per NEP Guidelines B.Sc. (Data Science) from 2024-25

(Level 6.0) SEMESTER VII (Honors with Research Degree)

Course	Course code	Course Name	Cre	dits	Tea	ching	Ex	amir	ation
Туре					Scł	neme	Scheme and		
					Hrs/Week		Marks		ks
			Т	Р	TH	PR	C	Ε	Total
			Н	R			Ε	Ε	
	DS-401-MJ-T	Machine Learning	4	-	4	-	30	70	100
Major	DS-402-MJ-T	Basics of Cloud Computing	2	-	2	-	15	35	50
Core	DS-403-MJ-P	Lab Course on DS-401-MJ-T	-	2	-	4	15	35	50
	DS-404-MJ-P	Lab Course on DS-402-MJ-T	-	2	-	4	15	35	50
	DS-410-MJ-T	Supply Chain & Logistics	2	-	2	-	15	35	50
	DS-410-MJ-1	Analytics							
Major	DS-411-MJ-P	Lab Course	-	2	-	4	15	35	50
Elective	OR								
	DS-412-MJ-T	Healthcare Analytics	2	-	2	-	15	35	50
	DS-413-MJ-P	Lab Course	-	2	-	4	15	35	50
RP	DS-431-RP	Research Project	-	4	-	8	30	70	100
RM	DS-441-RM	Research Methodology	4	-	4	-	30	70	100
		Total	12	10	12	20			550

OR

(Level 6.0) SEMESTER VII (Honors Degree)

Course	Course code	Course Name	Cre	dits	Tea	ching	Ex	amir	ation
Туре					Scł	neme	Scheme and		
					Hrs/	Week	Marks		
			Т	Р	TH	PR	С	Ε	Total
			Η	R			Ε	Ε	
	DS-401-MJ-T	Machine Learning	4	-	4	-	30	70	100
Major	DS-402-MJ-T	Basics of Cloud Computing	2	-	2	-	15	35	50
Core	DS-403-MJ-P	Lab Course on DS-401-MJ-T	-	2	-	4	15	35	50
Core	DS-404-MJ-P	Lab Course on DS-402-MJ-T	-	2	-	4	15	35	50
	DS-405-MJ-T	Big Data Analytics	4	-	4	-	30	70	100
	DS-410-MJ-T	Supply Chain & Logistics	2	-	2	-	15	35	50
	DS-410-MJ-1	Analytics							
Major	DS-411-MJ-P	Lab Course	-	2	-	4	15	35	50
Elective	OR								
	DS-412-MJ-P	Healthcare Analytics	2	-	2	-	15	35	50
	DS-413-MJ-P	Lab Course	-	2	-	4	15	35	50
RM	DS-441-RM	Research Methodology	4	-	4	-	30	70	100
		Total	16	6	16	12			550

Savitribai Phule Pune University Syllabus Structure as per NEP Guidelines

B.Sc. (Data Science) from 2024-25

(Level 6.0) SEMESTER VIII (Honors with Research Degree)

Course	Course code	Course Name	Cre	dits	Teac	hing	Ex	amina	tion
Туре					Scheme		Scheme and		
					Hrs/Week			Mark	s
			Т	Р	TH	PR	С	EE	Tota
			Н	R			Ε		1
	DS-451-MJ-T	Data Mining and	4	-	4	-	30	70	100
Major	DS-451-1015-1	Warehousing							
Core	DS-452-MJ-T	Deep Learning	2	-	2	-	15	35	50
Core	DS-453-MJ-P	Lab Course on DS-451-MJ-T	-	2	-	4	15	35	50
	DS-454-MJ-P	Lab Course on DS-452-MJ-T	-	2	-	4	15	35	50
	DS-460-MJ-T	Geospatial Technology	2	-	2	-	15	35	50
N 7 - *	DS-461-MJ-P	Lab Course	-	2	-	4	15	35	50
Major Elective	OR								
Liective	DS-462-MJ-T	E-Commerce	2	-	2	-	15	35	50
	DS-463-MJ-P	Lab Course	-	2	-	4	15	35	50
RP	DS-481-RP	Research Project	-	8	-	16	60	140	200
		Total	8	14	8	28			550

Award of Bachelor of Data Science (B.Sc.Data Science) Honors with Research degree with 176 credits

OR

(Level 6.0) SEMESTER VIII (Honors Degree)

Course	Course code	Course Name	Cre	dits		Teaching Examinati			ation	
Туре					Sch	neme	Scheme and			
					Hrs/	Hrs/Week		Marks		
			Т	Р	TH	PR	С	Ε	Total	
			Η	R			Ε	Ε		
	DS-451-MJ-T	Data Mining and	4	-	4	-	30	70	100	
	DS-431-MJ-1	Warehousing								
Major	DS-452-MJ-T	Deep Learning	2	-	2	-	15	35	50	
Core	DS-453-MJ-P	Lab Course on DS-451-MJ-T	-	2	-	4	15	35	50	
	DS-454-MJ-P	Lab Course on DS-452-MJ-T	-	2	-	4	15	35	50	
	DS-455-MJ-T	Natural Language Processing	4	-	4	-	30	70	100	
	DS-456-MJ-T	Geospatial Technology	2	-	2	-	15	35	50	
	DS-457-MJ-P	Lab Course	-	2	-	4	15	35	50	
Major Elective	OR									
Liective	DS-458-MJ-T	E-Commerce	2	-	2	-	15	35	50	
	DS-459-MJ-P	Lab Course	-	2	-	4	15	35	50	
OJT	DS-481-OJT	On Job Training	-	4	-	8	30	70	100	
		Total	12	10					550	

Award of Bachelor of Data Science (B.Sc. Data Science) Honors degree with 176 credits

Detail Syllabus B.Sc. (Data Science) Semester-I

DS-101-T : Problem Solving and Python Programming

No. of Credits: 2	Teaching Scheme	Examination Sch	neme
	Theory:2 Hrs /Week	Continuous Evalu	ation:15 Marks
		End Semester:35	Marks
Prerequisites			
Basic knowled	ge of mathematics, logic.		
• Puzzle solving	Aptitude		
• Knowledge of	problem solving tools like algor	ithms, flowcharts and p	seudo codes will
be an added ad	vantage		
Objectives			
• To teach stude	nts systematic and efficient pro	blem-solving methods,	including proble
analysis, algori	thm design, and solution impler	nentation.	
• To provide a s	solid understanding of the Pyth	on programming langu	age, including i
syntax, data tyj	pes, control structures, and function	tions.	
• To instill goo	d programming habits, includ	ling code readability,	commenting, ar
documentation			
• To nurture the	e ability to think algorithmical	ly and express solution	ns as step-by-ste
processes using	g Python programs.		
• To learn and up	nderstand Object Oriented Progr	ramming	
• To improve de	ebugging techniques and error	identification and cor	rection in Pytho
programs.			
Course Outcomes			
On Completion of this	course, student will be able to -	-	
	efficient algorithms for solving		
	ograms to implement algorithms		
	rect errors in Python programs u		ing techniques.
-	ect Oriented Concepts in Python		
	stand modules and packages in		• •
	onstrate the use of built-in data s		-
Unit	Name of Unit	Teaching	CO Targeted
No.		Hours	
1 Introduction	n to Problem Solving	5	CO 1
1 1 What is problem as	lying?		<u>I</u>
1.1 What is problem so 1.2 Problem solving st	0		
_	ition, characteristics, examples,	advantages and limitation	ons.
1.4 Flowcharts - defin	· 1 /		

1.4 Flowcharts - definition, notations, examples, advantages and limitations, Comparison with algorithms.

1.5 Pseudo codes - notations, examples, advantages and limitations.

- 1.6 Introduction to Programming
- 1.7 Programming Languages as tools, programming paradigms, types of languages
- 1.8 Converting pseudo-code to programs.

2	Introduction to Python	10	CO1, CO2,
			CO3, CO6

2.1 History, feature of Python, setting up path, working with python Interpreter, basic syntax, variable and data types, operators

2.2 Conditional statements-If, If-Else, nested if-else, Examples.

2.3 Looping-For, While, Nested loops, Examples

2.4 Control Statements-Break, Continue, Pass.

2.5 String Manipulation-Accessing String, Basic Operations, String Slices, Function and Methods, Examples.

2.6 Lists-Introduction, accessing list, operations, working with lists, function & methods.

2.7 Tuple-Introduction, accessing tuples, operations working, function & methods, Examples.

2.8 Dictionaries-Introduction, Accessing values in dictionaries, working with dictionaries, properties, function, Examples.

2.9 Functions-Defining a function, Calling a function, types of function, function arguments, anonymous function, global & local variable, Examples

-	Characteristic and the state of	0	004
3	Classes, Objects and Inheritance	8	CO4
3.1 Clas	ses and Objects		
3.1.1 Cl	asses as User Defined Data Type		
3.1.2 Ol	jects as Instances of Classes		
3.1.3 Cr	eating Class and Objects		
3.1.4 Cr	eating Objects By Passing Values		
3.1.5 Va	riables & Methods in a Class		
3.2 Inho	eritance		
3.2.1 Si	ngle Inheritance		
3.2.2 M	ıltilevel		
	altiple Inheritance		
3.2.4 H	brid Inheritance		
3.2.5 Hi	erarchical Inheritance		
3.2.6 IS	A Relationship and HAS-A Relationship		
4	Modules and Packages	7	CO5
4.1 Bui	t in Modules		
4.1.1 In	porting modules in python program		
4.1.2 W	orking with Random Modules.		
4.1.3 E.	g built-ins, time, date time, calendar, sys, etc		
4.2 Use	Defined functions		
4.2.1 St	ructure of Python Modules		
4.3 Pac	cages		
4.3.1 Pr	edefined Packages		
4.3.2 Us	er defined Packages		
Referen	ce Books		
1. 1	How to solve it by Computer, R.G. Dromey, Pearson Edu	ucation.	
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- 2. Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010
- 3. Dive into Python, Mike
- 4. Learning Python, 4th Edition by Mark Lutz
- 5. Programming Python, 4th Edition by Mark Lutz
- 6. Python Programming: An introduction to computer, John Zelle, 3rd Edition.
- 7. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
- 8. Introduction to Python Programming. Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019

DS-102-P : Lab Course on DS-101-T (Python Programming)

No. of	Credits: 2	Teaching Scheme	Examination Sche	me
		Practical: 4 Hrs/Week	Continuous Evaluat	tion: 15 Marks
			End Semester:	35 Marks
Prereg	luisites		I	
•	Basic knowledge	of logic and Python programn	ning concepts	
٠	Knowledge of pr	oblem solving tools like algorit	thms, flowcharts and pset	udo codes will
	be an added adva	intage		
Object	tives			
٠	Learn Programm	ing fundamentals using Python	l	
•	Understand the c	oncepts and usage data types, v	variables and other basic	elements
•	Learn about using	g operators and control stateme	ents in Python	
•	Learn about using	g arrays and strings in Python.		
•	Learn Object Ori	ented concepts in Python.		
٠	-	modules in packages in Pytho	n Programming	
		1 0 0		
CO1: "Sets".	Implement the u	ourse, students will be able to - use of built-in data structures ms on Arrays and Strings		" "Tuples" and
CO1: "Sets". CO2; 1 CO3: 1 CO4: 1	Implement the u Implement progra Implement progra Implement progra	use of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and on: of Practical Assignments for all	"lists" and "dictionary s in Python. packages in Python.	-
CO1: "Sets". CO2; 1 CO3: 1 CO4: 1	Implement the u Implement progra Implement progra Implement progra cal Implementation	use of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and on: of Practical Assignments for all	"lists" and "dictionary s in Python. packages in Python.	-
CO1: "Sets". CO2;] CO3:] CO4:] Practic	Implement the u Implement progra Implement progra Implement progra cal Implementation of Platform Indepe	use of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p on: of Practical Assignments for all endent. Name of Unit	"lists" and "dictionary s in Python. packages in Python.	cience) will be
CO1: "Sets". CO2;] CO3:] CO4:] Practic Unit No. 1	Implement the u Implement progra Implement progra Implement progra cal Implementation of Platform Indepo	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p ion: of Practical Assignments for all endent. Name of Unit to Python Language	"lists" and "dictionary s in Python. packages in Python. courses in B.Sc.(Data S Hours 8	cience) will be CO Targeted
CO1: "Sets". CO2;] CO3:] CO4:] Practic	Implement the u Implement progra Implement progra Implement progra Cal Implementation Implementation of Platform Indeport Introduction of Write a Python p	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p of Practical Assignments for all endent. Name of Unit to Python Language program to explore various data	"lists" and "dictionary s in Python. packages in Python. courses in B.Sc.(Data S Hours 8	cience) will be CO Targeted
CO1: "Sets". CO2;] CO3:] CO4:] Practic Unit No. 1 a.	Implement the u Implement progra Implement progra Implement progra Cal Implementation of Platform Indeport Write a Python p types and compo	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p fon: of Practical Assignments for all endent. Name of Unit to Python Language orogram to explore various data und types.	"lists" and "dictionary s in Python. packages in Python. l courses in B.Sc.(Data S Hours 8 4 types including numerio	cience) will be CO Targeted
CO1: "Sets". CO2; D CO3: D CO4: D Practic Unit No. 1 a. b.	Implement the u Implement progra Implement progra Implement progra Cal Implementation of Platform Indeport Write a Python p types and compo Write a Python p	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p on: of Practical Assignments for all endent. Name of Unit to Python Language program to explore various data und types. rogram to perform Input and C	 "lists" and "dictionary s in Python. packages in Python. courses in B.Sc.(Data S Hours 8 a types including numeric butput Operations. 	cience) will be CO Targeted CO1 c types, Boolean
CO1: "Sets". CO2; D CO3: D CO4: D Practic Unit No. 1 a. b.	Implement the u Implement progra Implement progra Implement progra Cal Implementation of Platform Indepo Vrite a Python p Write a Python p Write a Python p	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p fon: of Practical Assignments for all endent. Name of Unit to Python Language orogram to explore various data und types. rogram to perform Input and C program to demonstrate loopin	 "lists" and "dictionary s in Python. packages in Python. courses in B.Sc.(Data S Hours 8 a types including numeric butput Operations. 	cience) will be CO Targeted CO1 c types, Boolean
CO1: "Sets". CO2; D CO3: D CO4: D Practic Unit No. 1 a. b.	Implement the u Implement progra Implement progra Implement progra Cal Implementation of Platform Indepo Write a Python p types and compo Write a Python p	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p fon: of Practical Assignments for all endent. Name of Unit to Python Language orogram to explore various data und types. rogram to perform Input and C program to demonstrate loopin	 "lists" and "dictionary s in Python. packages in Python. courses in B.Sc.(Data S Hours 8 a types including numeric butput Operations. 	cience) will be CO Targeted CO1 c types, Boolean
CO1: "Sets". CO2; D CO3: D CO4: D Practic Unit No. 1 a. b.	Implement the u Implement progra Implement progra Implement progra Cal Implementation of Platform Indepo Write a Python p Write a Python p Write a Python p	ise of built-in data structures ms on Arrays and Strings ms on Object Oriented concept ms by importing modules and p fon: of Practical Assignments for all endent. Name of Unit to Python Language orogram to explore various data und types. rogram to perform Input and C program to demonstrate loopin	"lists" and "dictionary Is in Python. packages in Python. I courses in B.Sc.(Data S Hours A types including numerication of the python and use of the python and	cience) will be CO Targeted CO1 c types, Boolean

b.	Write a Python program to demonstrate the use of Built-in	n Functions	•
c.	Write a Python Program to implement Lambda Functions		
3	List, Tuples, Dictionaries and Sets	12	CO1
a.	Write a Python Program to create list, apply various funct	ions to it.	1
b.	Write a Python Program to demonstrate concept of aliasin		ing.
c.	Write a Python Program to implement tuples for storing	data. Veri	fy the immutabil
	property on tuples.		-
d.	Write a Python Program to implement Dictionary and ope	erations on	dictionaries.
e.	Write a Python Program to create sets and various operat	ions on it.	
4	Arrays and String	12	CO2
a.	Write a Python Program to implement arrays for storing h	omogeneou	us data items.
b.	Apply indexing and slicing operations to access elements	of array.	
c.	Write a Python Program to demonstrate operations and pr	operties of	string data types.
d.	Write a Python Program implement and demonstrate the	e use of Me	embership operato
	and Identity operators		
	J 1		
5		12	C03
5	Object Oriented Programming	12	CO3
a.	Object Oriented Programming Write a Python program to define classes and create object		CO3
a. b.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance.		CO3
a.	Object Oriented Programming Write a Python program to define classes and create object		CO3
a. b.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance.		CO3
a. b. c.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism.	ets. 8	
a. b. c. 6	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages	ets. 8 modules.	
a. b. c. 6 a. b.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined	ets. 8 modules.	
a. b. c. 6 a. b.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined	8 modules. packages.	
a. b. c. 6 a. b.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined eference Books How to solve it by Computer, R.G. Dromey, Pearson Education	8 modules. packages.	
a. b. c. 6 a. b. Re	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined eference Books How to solve it by Computer, R.G. Dromey, Pearson Edu Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2	8 modules. packages.	
a. b. c. 6 a. b. Re	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined eference Books How to solve it by Computer, R.G. Dromey, Pearson Edu Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2 Dive into Python, Mike	8 modules. packages.	
a. b. c. 6 a. b. 8 6 1. 2. 3. 4.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Geference Books How to solve it by Computer, R.G. Dromey, Pearson Edu Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2 Dive into Python, Mike Learning Python, 4th Edition by Mark Lutz	8 modules. packages.	
a. b. c. 6 a. b. Re 1. 2. 3.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to program to import built in and user defined Eference Books How to solve it by Computer, R.G. Dromey, Pearson Edu Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2 Dive into Python, Mike Learning Python, 4th Edition by Mark Lutz Programming Python, 4th Edition by Mark Lutz	8 modules. packages.	CO4
a. b. c. 6 a. b. 7 6 1 . 2. 3. 4. 5. 6.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to program to import built in and user defined Programing Python, Nike Learning Python, Mike Learning Python, 4th Edition by Mark Lutz Programming Python, 4th Edition by Mark Lutz Python Programming:An introduction to computer, John Z	8 modules. packages. ucation. 2010 Zelle,3rd Ed	CO4
a. b. c. 6 a. b. 8 6 1. 2. 3. 4. 5.	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Geference Books How to solve it by Computer, R.G. Dromey, Pearson Edu Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2 Dive into Python, Mike Learning Python, 4th Edition by Mark Lutz Programming Python, 4th Edition to computer, John Z Data Science Essentials in Python: Collect, Organize, E	8 modules. packages. ucation. 2010 Zelle,3rd Ed	CO4
a. b. c. 6 a. b. 7 8 6 7	Object Oriented Programming Write a Python program to define classes and create object Program to implement the inheritance. Program to implement the polymorphism. Modules and Packages Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to import built in and user defined Write Python program to program to import built in and user defined Programing Python, Nike Learning Python, Mike Learning Python, 4th Edition by Mark Lutz Programming Python, 4th Edition by Mark Lutz Python Programming:An introduction to computer, John Z	8 modules. packages. ucation. 2010 Zelle,3rd Ed xplore, Pre	CO4

DS-103-T : Descriptive Statistics

No. of C	redits: 02	Teaching Scheme	Exan	nination Sch	eme
		Theory: 2 Hours/Week	Conti	nuous Evalu	ation:15 Marks
			End S	Semester : 35	Marks
Prerequi	isites	•	1		
• N	Iathematical op	erations			
Objectiv	res				
• T	o acquaint stud	ents with some basic concepts in	Statistic:	S	
• T	o introduce to s	some elementary statistical method	ods of ana	alysis of data	L
• T	o identify the n	ature and type of data			
• T	o apply statistic	eal tools to numerical and catego	rical data		
Course (Outcomes				
On Com	pletion of this c	ourse, student will be able to –			
CO1: Ide	entify the differe	ent types of variables and data.			
CO2:Co1	npute various n	neasures of central tendency, dis	persion,		
CO3: Co	mpute various i	measures of skewness and kurtos	sis.		
CO4: Fir	d correlation co	pefficient between numerical van	iables.		
CO5: Fit	linear regressio	on lines.			
CO6: Fit	non-linear regr	ression lines.			
Unit No.		Name of Unit		Teaching Hours	CO Targeted
		Introduction to Statistics		02	CO1
1]				
_		nd its importance in data science	ce. Conce	ept of popula	ation and sample
Meaning	of Statistics an				
Meaning Types of	of Statistics and characteristics	nd its importance in data science	s of data	(primary and	secondary). Rav
Meaning Types of data and	of Statistics and characteristics	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri	s of data	(primary and	secondary). Raw
Meaning Types of data and	of Statistics and characteristics its classification alative frequence	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri	s of data bution, g	(primary and	secondary). Raw
Meaning Types of data and and cumu 2	of Statistics and characteristics its classification ulative frequence Measures o	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution.	s of data bution, g rsion	(primary and rouped frequ 10	secondary). Rav uency distribution
Meaning Types of data and and cumu 2 Measure	of Statistics and characteristics its classification alative frequence Measures of s of central t	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency districtly by distribution. f Central Tendency and Dispe	s of data bution, g rsion	(primary and rouped frequ 10 of statistica	secondary). Rav uency distribution CO2 1 data. Statistica
Meaning Types of data and and cum 2 Measure averages	of Statistics and characteristics its classification alative frequence Measures on es of central t chrithmetic me	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central	s of data bution, g rsion tendency e of origin	(primary and rouped frequ 10 of statistica n and scale),	secondary). Rav uency distribution CO2 1 data. Statistica Geometric Mean
Meaning Types of data and and cumu 2 Measure averages and Har	of Statistics and characteristics its classification alative frequence Measures on es of central t chrithmetic me	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central te ean (Definition, effect of changed median and mode, partition y	s of data bution, g rsion tendency e of origin	(primary and rouped frequ 10 of statistica n and scale),	secondary). Rav uency distribution CO2 1 data. Statistica Geometric Mean
Meaning Types of data and and cumu 2 Measure averages and Har ungroupe	of Statistics and characteristics its classification alative frequence Measures on es of central t Arithmetic me monic Mean, ed and grouped	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central te ean (Definition, effect of changed median and mode, partition y	s of data bution, g rsion tendency e of origin values (D	(primary and rouped frequ 10 of statistica n and scale),	secondary). Rav uency distribution CO2 1 data. Statistica Geometric Mean
Meaning Types of data and and cumu 2 Measure averages and Har ungroupe Situation	of Statistics and characteristics its classification alative frequence Measures on es of central t chrithmetic mean, ed and grouped s where one kin	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central te ean (Definition, effect of change median and mode, partition y data).	s of data bution, g rsion tendency e of origin values (E er.	(primary and rouped frequ 10 of statistica n and scale), Definitions a	secondary). Rav uency distribution CO2 1 data. Statistica Geometric Mean nd examples fo
Meaning Types of data and and cumu 2 Measure averages and Har ungroupe Situation Measure	of Statistics and characteristics its classification alative frequence Measures o es of central t chrithmetic me monic Mean, ed and grouped s where one kin es of dispersio	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central to ean (Definition, effect of changed median and mode, partition of data). and of average is preferable to oth	s of data bution, g rsion tendency e of origin values (E er. nge, Semi	(primary and rouped frequ 10 of statistica n and scale), Definitions a	secondary). Rav uency distribution CO2 I data. Statistica Geometric Mean nd examples fo e range (Quartil
Meaning Types of data and and cumu 2 Measure averages and Har ungroupe Situation Measure deviation	of Statistics and characteristics its classification alative frequence Measures on es of central t chrithmetic mean, ed and grouped s where one kin es of dispersion a): Definition.	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central te ean (Definition, effect of change median and mode, partition v data). nd of average is preferable to oth n: Concept of dispersion. Rar	s of data bution, g rsion tendency e of origin values (D er. nge, Semi minimalit	(primary and rouped frequ 10 of statistica n and scale), Definitions a i-interquartily ty property	secondary). Rav uency distribution CO2 l data. Statistica Geometric Mean nd examples fo e range (Quartile (without proof)
Meaning Types of data and and cum 2 Measure averages and Har ungroupe Situation Measure deviation Variance deviation	of Statistics and characteristics its classification alative frequence Measures of es of central t chrithmetic mean, ed and grouped s where one kin es of dispersion and standard d and grouped here one kin es of dispersion	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central to ean (Definition, effect of change median and mode, partition of data). nd of average is preferable to oth n: Concept of dispersion. Rar Mean deviation: Definition, eviation: Definition, effect of change inimality property of mean squa	s of data bution, g rsion tendency e of origin values (D er. nge, Semi minimalition ange of corred deviation	(primary and rouped frequ of statistica n and scale), Definitions a i-interquartile ty property origin and sca tion (without	e range (Quartile (without proof) ale. Mean squared proof), Measured
Meaning Types of data and and cum 2 Measure averages and Har ungroupe Situation Measure deviation Variance deviation	of Statistics and characteristics its classification alative frequence Measures of es of central t chrithmetic mean, ed and grouped s where one kin es of dispersion and standard d and grouped here one kin es of dispersion	nd its importance in data science (variables and attributes), Types on. Ungrouped frequency distri- cy distribution. f Central Tendency and Dispe rendency: Concept of central te ean (Definition, effect of change median and mode, partition v data). and of average is preferable to oth n: Concept of dispersion. Rar Mean deviation: Definition, eviation: Definition, effect of change	s of data bution, g rsion tendency e of origin values (D er. nge, Semi minimalition ange of corred deviation	(primary and rouped frequ of statistica n and scale), Definitions a i-interquartile ty property origin and sca tion (without	e range (Quartile (without proof) ale. Mean squared proof), Measured

coefficient of mean deviation, coefficient of variation(C.V.).

3	Moments, Skewness and Kurtosis	04	CO3				
Moments: Raw moments and Central Moments (Definition for for ungrouped and grouped							
	Relation between Raw moments and Central Moments (up						
Skewn	ess: Concept of skewness of frequency distribution,	positive sk	ewness, negative				
skewne	ess, symmetric frequency distribution. Bowley's coefficient	ent of skewne	ess(Definition and				
Examp	les and Bowley's coefficient of skewness lies between	-1 to 1 (with	hout proof)). Karl				
Pearso	n's coefficient of skewness (Definition and Examples). N	Aeasures of s	kewness based on				
momen	ts (Definition and Examples).						
Kurto	sis: Concept of kurtosis, leptokurtic, mesokurtic and platy	ykurtic freque	ency distributions.				
Measu	res of kurtosis based on moments (Definition and Example	es).					
4	Correlation and Regression	10	CO4, CO5				
Correl	ation: Bivariate data, Scatter diagram and its interpretation	on. Concept	of Covariance and				
its pro	perties. Correlation between two variables and its types	. Karl Pearso	on's coefficient of				
correla	tion (r) and its computation for ungrouped data. Proper	ties of correl	ation. Spearman's				
rank co	prrelation coefficient and its computation.						
Regres	ssion: Concept of dependent (response) and indepen	dent (predic	tor or regerssor)				
	es. Meaning of regression, connection between correlation	-	-				
	$+\beta_1 X,\beta_0$ and β_1 are regression coefficients which are						
	I. Properties of regression coefficients. Concept of explai		=				
	ient of determination, standard error of an estimate of	line of regre	ssion. Concept of				
	regression.	1	1				
5	Non-linear Regression	04	CO6				
	ity and importance of fitting of non-linear regression						
	$Y = a + bX + cX^2$), Fitting of exponential curves of the	e type $Y = a$	ab^x and $Y = ax^b$.				
-	of logistic curve.						
	nce Books						
1.	Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fur	ndamentals of	f Statistics, Vol. 1,				
	Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta	l.					
2.	Gupta, S. C. and Kapoor, V. K. (1997). Fundamental	s of Applied	d Statistics, Third				
	Edition, Sultan Chand and Sons Publishers, New Delhi.						
	Neil, A. Weiss, (2016). Introductory Statistics, Tenth Edit						
4.	Purohit, S. G., Gore S. D., Deshmukh S. R. (2008)). Statistics	Using R, Narosa				
	Publishing House, NewDelhi.						
5.	Sarma, K. V. S. (2001). Statistics Made it Simple: Do it y	ourself on P	C. Prentice Hall of				
	India, NewDelhi.						

- 6. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. EastWest Press.
- 7. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill BookCompany.

DS-104-P : Lab Course on DS-103-T (Descriptive Statistics)

No. of (Credits: 02	Teaching Scheme	Examination	Scheme	
		Practical: 4 Hours/Week	Continuous Ex	valuation:15	Marks
			End Semester	: 35 Marks	
Prerequ	uisites				
•]	Mathematical of	perations			
Objecti	ves				
• ′	To acquaint stud	lents with some basic concepts	in Statistics		
• ′	To introduce to	some elementary statistical me	hods of analysis of	data	
• ′	To identify the 1	nature and type of data			
• ′	To apply statisti	cal tools to numerical and cate	orical data		
Course	Outcomes				
On Con	pletion of this o	course, student will be able to -			
CO1: Id	lentify the differ	ent types of variables and data			
CO2:Co	mpute various	measures of central tendency, d	ispersion,		
CO3: C	ompute various	measures of skewness and kur	osis.		
CO4: Fi	ind correlation c	coefficient between numerical v	ariables		
			ariables.		
CO5: Fi	it linear regressi				
	it linear regressi	on lines.	anabies.		
		on lines.	ariables.		
CO6: Fi	it linear regressi	on lines.			Hours
CO6: Fi	it linear regressi it non-linear reg	on lines. ression lines.	nments		Hours 4
CO6: Fi Sr.No.	it linear regressi it non-linear reg Diagrammatic	on lines. ression lines. List of Practical Assig	nments on of statistical data.		
CO6: Fi Sr.No. 1	it linear regressi it non-linear reg Diagrammatic	on lines. ression lines. List of Practical Assig representation and interpretation	nments on of statistical data.		4
CO6: Fi	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation	on lines. ression lines. List of Practical Assig representation and interpretation	nments on of statistical data statistical data		4 4 4
CO6: Fi Sr.No. 1 2	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of	nments on of statistical data statistical data		4
CO6: Fi	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation o data	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of	nments on of statistical data statistical data for grouped and un	grouped	4 4 4
CO6: Fi	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation o data Computation o	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency	nments on of statistical data statistical data for grouped and un ind ungrouped data.	grouped	4 4 4 4
CO6: Fi	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Computation of	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped	grouped ed data	4 4 4 4 4 4 4
CO6: Fi Sr.No. 1 2 3 4 5	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Computation of	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped a of measures of dispersion for grouped of measures of dispersion for grouped and the nature of probability distributed of probability distributed	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped	grouped ed data	4 4 4 4 4
CO6: Fi Sr.No. 1 2 3 4 5 6 7	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification skewness and	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped a of measures of dispersion for grouped of measures of dispersion for grouped and the nature of probability distributed of probability distributed	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ition based on meas	grouped ed data sure of	4 4 4 4 4 4 4 4
CO6: Fi Sr.No. 1 2 3 4 5 6	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification skewness and	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped a of measures of dispersion for grouped the nature of probability distrib kurtosis.	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ition based on meas	grouped ed data sure of	4 4 4 4 4 4 4
CO6: Fi Sr.No. 1 2 3 4 5 6 7	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification of skewness and Plotting of Sca (ungrouped data)	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped of measures of dispersion for grather the nature of probability distribution kurtosis.	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ution based on meas of correlation coeffic	grouped ed data sure of	4 4 4 4 4 4 4 4
CO6: Fi Sr.No. 1 2 3 4 5 6 7 8 9	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification of skewness and Plotting of Sca (ungrouped da Computation of	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped a of measures of dispersion for grather nature of probability distributes kurtosis. atter diagram and computation of ta).	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ition based on meas of correlation coeffic coefficient.	grouped ed data sure of cient	4 4 4 4 4 4 4 8 8 4
CO6: Fi Sr.No. 1 2 3 4 5 6 7 8	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification of skewness and Plotting of Sca (ungrouped da Computation of	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped of measures of dispersion for grather the nature of probability distribution kurtosis.	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ition based on meas of correlation coeffic coefficient.	grouped ed data sure of cient	4 4 4 4 4 4 4 8
CO6: Fi Sr.No. 1 2 3 4 5 6 7 8 9	t linear regressi t non-linear reg Diagrammatic Graphical repr Tabulation Computation of data Computation of Identification skewness and Plotting of Sca (ungrouped da Computation of Fitting of simp Y).	on lines. ression lines. List of Practical Assig representation and interpretation resentation and interpretation of of measures of central tendency of partition values for grouped a of measures of dispersion for grather nature of probability distributes kurtosis. atter diagram and computation of ta).	nments on of statistical data statistical data for grouped and un ind ungrouped data. ouped and ungrouped ition based on meas of correlation coeffic coefficient.	grouped ed data sure of cient	4 4 4 4 4 4 4 8 8 4

Reference Books

- 1. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
- 2. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
- 3. Neil, A. Weiss, (2016). Introductory Statistics, Tenth Edition, Pearson.
- 4. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi.
- 5. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, NewDelhi.
- 6. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. EastWest Press.
- 7. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill BookCompany.

DS-105-T : Computational Mathematics

110.01 C	credits: 2	Teaching Scheme	Examination Sc	heme
		Theory: 2 Hrs/Week	Continuous Evalu	uation:15 Marks
			End Semester: 35	5 Marks
Prerequ	isites			
•	Basic Mathem	natics Skills		
Objectiv	ves			
 1 	Yo understand t eterminants, usin Yo solving system Yo understand the inear independen Yo abstract notion Yo understand for ransformation, ar	he basic arithmetic operating technology where approprises of linear equations, using the basic terminology of linear equations, rank, nulling of vector space and inner prind the eigen values and using them to diagonalize projections and orthogonalit	iate. echnology to facilitate r ear algebra in Euclidea llity, subspace, and linea product space. l eigenvectors of a r a matrix.	row reduction. In spaces, includin ar transformation. matrix or a linea
	Outcomes pletion of this co	wroe student will be able to		
CO2: De CO3: De	lve systems of line emonstrate under etermine eigen va	near equations using method standing of the concepts of v alues and eigenvectors and so	s by Gaussian eliminatio ector space, linear indep lve eigenvalue problem	pendence and basis.
CO2: De CO3: De CO4: D	lve systems of line emonstrate under etermine eigen va emonstrate under	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth	s by Gaussian eliminatio ector space, linear indep lve eigenvalue problem	pendence and basis.
CO2: De CO3: De CO4: D commuta	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth ation.	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion	pendence and basis. s. dentity, distributive
CO2: De CO3: De CO4: D commuta CO5: Si	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and prov	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion	pendence and basis. s. dentity, distributive
CO2: De CO3: De CO4: D commuta	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and prov	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth ation.	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion npute sum of products	pendence and basis. s. dentity, distributive and product of sur
CO2: De CO3: De CO4: D commuta CO5: Si expansio	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and prov	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth ation. e Boolean expressions, Con	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion	pendence and basis. s. dentity, distributive
CO2: De CO3: De CO4: D commuta CO5: Si expansion Unit	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and prov	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion pute sum of products Teaching	pendence and basis. s. dentity, distributive and product of sur
CO2: De CO3: De CO4: D commuta CO5: Si expansion Unit No. 1	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and provens.	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion npute sum of products Teaching Hours 6	pendence and basis. is. dentity, distributive and product of sur CO Targeted CO1
CO2: De CO3: De CO4: D commut CO5: Si expansic Unit No. 1 Matrices	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and provens.	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion npute sum of products Teaching Hours 6	condence and basis s. dentity, distributive and product of sur CO Targeted CO1
CO2: De CO3: De CO4: D commuta CO5: Si expansice Unit No. 1 Matrices	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and provens.	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon fo	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion npute sum of products Teaching Hours 6	condence and basis s. dentity, distributive and product of sur CO Targeted CO1
CO2: De CO3: De CO4: D commuta CO5: Si expansic Unit No. 1 Matrices method. 2	lve systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and prov ons. System of Line , Determinants, Vector Spaces	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon fo	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of ion npute sum of products Teaching Hours 6 orm, Row reduction, Content 8	endence and basis s. dentity, distributive and product of sur CO Targeted CO1 baussian eliminatio
CO2: De CO3: De CO3: De CO4: D commuta CO5: Si expansic Unit No. 1 Matrices method. 2 Introduc independ	Ive systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and provens. System of Line , Determinants, Vector Spaces tion to vector spaces	near equations using method standing of the concepts of v alues and eigenvectors and sc erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon fo	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of iden pute sum of products Teaching Hours 6 orm, Row reduction, Control 8 vector spaces, Linear of the spaces of the spaces of the space o	endence and basis s. dentity, distributive and product of sur CO Targeted CO1 daussian eliminatio CO1, CO2 combination, Linea
CO2: De CO3: De CO3: De CO4: D commuta CO5: Si expansion Unit No. 1 Matricess method. 2 Introducc independo space.	Ive systems of line emonstrate under etermine eigen va emonstrate under ative, and domina mplify and provens. System of Line , Determinants, Vector Spaces tion to vector system lence, Linear dep	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon for paces, Some properties of pendence, Basis and Dimens	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of iden pute sum of products Teaching Hours 6 orm, Row reduction, Control 8 vector spaces, Linear of sion of a vector space, 1	endence and basis. dentity, distributive and product of sur CO Targeted CO1 daussian eliminatio CO1, CO2 combination, Linea Row space, Colum
CO2: De CO3: De CO4: D commuta CO5: Si expansic Unit No. 1 Matrices method. 2 Introduc independ space. 3	Ive systems of line emonstrate under etermine eigen va- emonstrate under ative, and domina mplify and prov- ons. System of Line , Determinants, Vector Spaces tion to vector spaces lence, Linear dep Eigen values a	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon for paces, Some properties of pendence, Basis and Dimens nd Eigen vectors	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of it npute sum of products Teaching Hours 6 orm, Row reduction, C 8 vector spaces, Linear of sion of a vector space, 5	endence and basis. dentity, distributive and product of sur CO Targeted CO1 daussian eliminatio CO1, CO2 combination, Linea Row space, Colum
CO2: De CO3: De CO4: D commuta CO5: Si expansic Unit No. 1 Matrices method. 2 Introduc independ space. 3	Ive systems of line emonstrate under etermine eigen va- emonstrate under ative, and domina mplify and prov- ons. System of Line , Determinants, Vector Spaces tion to vector spaces lence, Linear dep Eigen values a	near equations using method standing of the concepts of v alues and eigenvectors and so erstanding the use of truth ation. e Boolean expressions, Con Name of Unit ear Equation Cramer's Rule, Echelon for paces, Some properties of pendence, Basis and Dimens	s by Gaussian elimination ector space, linear indepolve eigenvalue problem tables and laws of it npute sum of products Teaching Hours 6 orm, Row reduction, C 8 vector spaces, Linear of sion of a vector space, 5	pendence and basis. is. dentity, distributive and product of sur CO Targeted CO1 Gaussian elimination CO1, CO2 combination, Linea Row space, Column CO3

Relations, Types of Relations, Equivalence relations, Digraphs of relations, Matrix representation and Composition of Relations, Transitive closure and Warshall's Algorithm, Poset, Hasse diagram, Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra, Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Reference Books

- 1. Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Ninth Edition, Wiley, 11th edition.
- 2. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi.
- 3. Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi.
- 4. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall

DS-106-P: Lab Course on DS-105-T (Computational Mathematics)

	redits: 2	Teaching Scheme	Examination Scheme	
		Practical : 4 Hours/Week	Continuous Evaluation:15	Marks
			End Semester: 35 Marks	
Prerequ	isites			
• B	Basic Mathematic	Skills		
Objectiv	/es			
d • T • T li	eterminants, usin 'o solve systems of 'o understand the near independence	g technology where appropriof of linear equations, using sof basic terminology of linear a ce, spanning, basis.	tware to facilitate row reduction. Ilgebra in Euclidean spaces, inclu	
		s of vector space and inner p	-	
	iagonalize a matr		ectors of a matrix and using them	1 (0
	-		sions. Compute sum of products	and
	roduct of sum ex	• • •	I F T	
-	-	se maxima software.		
Course	Outcomes			
On Com	pletion of this cou	urse, student will be able to -		
CO1: Un	derstand the syst	ems of linear equations using	g methods by Gaussian elimination	on.
CO2: De	monstrate unders	tanding of the concepts of ve	ector space, linear independence	and basis
		es and eigenvectors problem	5.	
CO4: De	4 4 41			
		e of truth tables and laws of i	dentity, distributive, commutative	e, and
dominati	on.		dentity, distributive, commutative	
dominati CO5: Sir	on. nplify and prove			
dominati CO5: Sir expansio	on. nplify and prove ns.	Boolean expressions, Comp	dentity, distributive, commutative	
dominati CO5: Sir expansio	on. nplify and prove ns.		dentity, distributive, commutative	
dominati CO5: Sir expansio CO6: Stu	on. nplify and prove ns.	Boolean expressions, Comp	dentity, distributive, commutative ate sum of products and product of by using maxima software.	of sum
dominati CO5: Sir expansio	on. nplify and prove ns. udents can solve t	Boolean expressions, Comp he problem based on theory	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments	of sum
dominati CO5: Sir expansio CO6: Stu Sr.No.	on. nplify and prove ns. udents can solve t Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written)	of sum Hours
dominati CO5: Sir expansio CO6: Stu Sr.No. 1	on. nplify and prove ns. udents can solve t Problem Solving Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi g on Unit 1: System of Line	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written)	of sum Hours 4
dominati CO5: Sir expansio CO6: Stu Sr.No. 1 2	on. nplify and prove ns. idents can solve t Problem Solving Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi g on Unit 1: System of Line g on Unit 2: Vector Spaces	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written) Written) nd Eigen vectors (Written)	of sum Hours 4 8
dominati CO5: Sir expansio CO6: Stu Sr.No. 1 2 3	on. nplify and prove ns. idents can solve t Problem Solving Problem Solving Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi g on Unit 1: System of Line g on Unit 2: Vector Spaces g on Unit 3: Eigen values a	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written) Written) and Eigen vectors (Written) ion (Written)	of sum Hours 4 8 8
dominati CO5: Sir expansio CO6: Stu Sr.No. 1 2 3 4	on. nplify and prove ns. udents can solve t Problem Solving Problem Solving Problem Solving Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi g on Unit 1: System of Line g on Unit 2: Vector Spaces g on Unit 3: Eigen values a g on Unit 4: Boolean funct	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written) Written) nd Eigen vectors (Written) ion (Written) ar Equation (Using Maxima	Hours 4 8 8 8 8
dominati CO5: Sir expansio CO6: Stu Sr.No. 1 2 3 4 5	on. nplify and prove ns. idents can solve t Problem Solving Problem Solving Problem Solving Problem Solving Problem Solving Software) Problem Solving	Boolean expressions, Comp he problem based on theory List of Practical Assi g on Unit 1: System of Line g on Unit 2: Vector Spaces g on Unit 3: Eigen values a g on Unit 4: Boolean funct g on Unit 1: System of Line g on Unit 2: Vector Spaces g on Unit 2: Vector Spaces g on Unit 3: Eigen values a	dentity, distributive, commutative ate sum of products and product of by using maxima software. gnments ar Equation (Written) Written) and Eigen vectors (Written) ion (Written) ar Equation (Using Maxima (Using Maxima Software)	Hours 4 8 8 8 8 8 8

Reference Books

- 1. Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Ninth Edition, Wiley, 11th edition.
- 2. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi.
- 3. Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi.
- 4. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall

SEC-101-DS: Computer Organization

	of Credits:	Teaching Scheme	Examination S	cheme	
140.	2	Theory: 2 Hours/Week	Continuous Eva	luation	:15 Marks
	2		End Semester :	35 Mark	KS
Prerequ	isites				
• 1	Number systems a	nd basics of digital electronic	S.		
Objectiv	ves				
• 7	To revise about di	fferent number systems, code	s, logic gates with t	ruth tab	oles.
• 7	To understand con	nbinational and sequential cir	cuits of digital elec	tronics.	
• 7	To conceptualize t	he basics of organizational ar	d architectural issu	es of a	digital computer
	-	rious data transfer techniques			
• 7	To know how I/O	devices are accessed and its p	rinciples and to pro	ovide th	e knowledge on
	nstruction Level I		1		C
• 7	To study architect	ture			
	Outcomes				
On Com	pletion of this cou	urse, student will be able to -			
CO1: U	nderstand number	r systems related to computer	and their inter-con-	version.	
CO2: Fa	amiliar with digita	al circuits, their types, and app	olications.		
		nd Memory organizations for		f compu	iter.
CO4: St	udy interfacing of	f peripherals with CPU in ser	al and parallel man	ner wit	h data
converto	ors.				
CO5.St	idy basics of mici				
005.50	ady busies of filler	roprocessor architecture and c	oncept of pipelinin	g	
005.50	day busies of filler	roprocessor architecture and c	oncept of pipelinin	g	
Unit		-		g ching	CO Targeted
		Name of Unit	Tea	-	CO Targeted
Unit No. 1	Digital Circuits	Name of Unit	Tea H	oching ours 12	CO1, CO2
Unit No. 1 Number	Digital Circuits Systems: Binary	Name of Unit s , Hexadecimal, BCD and the	Tea H eir inter-conversion	ching ours 12 . Gray	CO1, CO2 code and ASCI
Unit No. 1 Number code. Lo	Digital Circuits Systems: Binary ogic Gates: Basic	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive	Tea H eir inter-conversion and negative logic	ching ours 12 . Gray , Simpl	CO1, CO2 code and ASCI ification of logic
Unit No. 1 Number code. Lo circuits,	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and	Tea H eir inter-conversion and negative logic simplification of si	ching ours 12 . Gray , Simpl ngle exj	CO1, CO2 code and ASCI ification of logic pressions (upto 4
Unit No. 1 Number code. Lo circuits, variables	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad	eir inter-conversion and negative logic simplification of si der, half Subtracto	ching ours 12 . Gray , Simpl ngle exj r, Multi	CO1, CO2 code and ASCI ification of logic pressions (upto 4 plexer (2:1 and
Unit No. 1 Number code. Lo circuits, variables 4:1), De	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad and 1:4) using basic gates, En	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto coder - Decimal to	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD,	CO1, CO2 code and ASCI ification of logic pressions (upto 4 plexer (2:1 and Decoder - 3 to 8
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder.	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad and 1:4) using basic gates, En uits: Concept of triggering,	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto coder - Decimal to Flip-Flops: SR, J	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD, IK, D	CO1, CO2 code and ASCI ification of logic pressions (upto 4 plexer (2:1 and Decoder - 3 to 2
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder.	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu nous and Asynchi	Name of Unit S , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad and 1:4) using basic gates, En uits: Concept of triggering, ronous (3-bit), Shift registers:	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto coder - Decimal to Flip-Flops: SR, J	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD, IK, D	CO1, CO2 code and ASCI ification of logic pressions (upto 4 plexer (2:1 and Decoder - 3 to 3 and T.Counters
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder.	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu nous and Asynchi	Name of Unit s , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad and 1:4) using basic gates, En uits: Concept of triggering,	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto coder - Decimal to Flip-Flops: SR, J types and applicati	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD, IK, D	CO1, CO2 code and ASCI ification of logic pressions (upto 4 plexer (2:1 and Decoder - 3 to 2
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder. Synchro 2	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu nous and Asynchi CPU, Memory	Name of Unit S , Hexadecimal, BCD and the gates, derived gates, positive orem. Concept of K map and l circuits: Half adder, full ad and 1:4) using basic gates, En uits: Concept of triggering, ronous (3-bit), Shift registers:	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto coder - Decimal to Flip-Flops: SR, J types and applicati	ching ours 12 . Gray , Simpl ngle exj r, Multi b BCD, IK, D ons. 12	CO1, CO2 code and ASCI ification of logic pressions (upto 4 iplexer (2:1 and Decoder - 3 to 3 and T.Counters CO3, CO4
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder. Synchro 2 CPU O pointer,	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu nous and Asynchi CPU, Memory rganization: Fur instruction registe	Name of Unit Name of Unit Name of Unit Name of Unit Name of Unit Name of Unit S () () () () () () () () () ()	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto icoder - Decimal to Flip-Flops: SR, J types and applicati gisters used in CP general purpose reg	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD, IK, D ons. 12 U: PC, gisters,	CO1, CO2 code and ASCI ification of logic pressions (upto 4 iplexer (2:1 and Decoder - 3 to 4 and T.Counters CO3, CO4 SP, instruction memory addres
Unit No. 1 Number code. Lo circuits, variables 4:1), De decoder. Synchro 2 CPU O pointer,	Digital Circuits Systems: Binary ogic Gates: Basic De-Morgan's the s). Combinational multiplexer (1:2 a Sequential circu nous and Asynchi CPU, Memory rganization: Fur instruction registe	Name of Unit Name of Unit Name of Unit Name of Unit Name of Unit Name of Unit S S S S S S S S S S S S S	Tea H eir inter-conversion and negative logic simplification of si der, half Subtracto icoder - Decimal to Flip-Flops: SR, J types and applicati gisters used in CP general purpose reg	ching ours 12 . Gray , Simpl ngle exj r, Multi o BCD, IK, D ons. 12 U: PC, gisters,	CO1, CO2 code and ASCI ification of logi pressions (upto plexer (2:1 and Decoder - 3 to and T.Counters CO3, CO4 SP, instruction memory addres
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interrupt, IVT, Types of I/O transfer, CPU initiated, interrupt initiated, DMA (only concept),Data convertors:R-2RDAC, ADC (flash, successive approximation), Serial communication and types.

2	Architecture of	Microprocessor and P	arallel		6	CO5	
3	Processing				U	05	
1.4		D1 1 1	60006	1.0		000 C D 1	

Architecture of Microprocessor: Block diagram of 8086 and function of blocks, 8086 Registers, Numeric co-processor - concept, block diagram and functions of blocks.

Parallel Processing: Concept of parallelism, Parallel computer structures. Concept of pipelining, Pipelined computers, Instruction pipeline, Arithmetic pipeline, Concept of RISC and CISC. RISC pipelining.

Reference Books

1. Modern Digital Electronics, 4thedition, R P Jain, Tata McGraw Hill publication.

2. Digital Logic & Computer Design, Morris Mano, Pearson.

3. Computer Systems Architecture – Moris Mano, 3rdEdition, Pearson

4. Computer Systems Organization & Architecture- John D. Carinelli Pearson publication.

Semester-I

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-101-DS-T : Office Automation I

No. of C	redits:	Teaching	Scheme	Exan	nination Sch	neme
02		Practical:	2 Hrs/Week	Cont	tinuous Evalı	uation:15 Marks
				End S	Semester :	35 Marks
Prerequ	isites					
• Previ	ious knowledge o	f Computer	concepts is assu	med.		
• Knov	wledge of Compu	ter as operat	ional tool is requ	uired.		
Objectiv	/es					
• To in	troduce the found	lations of of	fice automation	especially v	word process	ing.
• To de	evelop the ability	to prepare tl	ne well formatte	d word doc	uments.	
• To p	repare the docume	ents using w	ord processing t	ools such a	s tables, figu	res, shapes etc.
• To p	repare the word d	ocuments us	ing advanced au	itomated fe	atures.	
Course	Outcomes					
On Com	pletion of this cou	ırse, student	will be able to -			
CO1: Pro	epare the profession	onal word de	ocuments			
CO2: Ex	plore various tool	ls in the wor	d processing sof	ftware		
CO3: De	evelop documents	using word	processing adva	inced tools		
Unit		Name of	f Unit		Teaching	CO Targeted
No.					Hours	
1	Working with	Documents			2	CO1
-	ning & Saving fil					
	ing text document	-	Deleting,			
	Copy, Paste, Uno					
	l, Search, Replace					
	natting page &set					
	verting files to dif			1		
-	orting & Exportin	-	-	to others,		
	ng Tool bars, Rule		ns, using help			CO1
2	Formatting Do	cuments			2	CO1
	ng Font styles					
	selection- style, s					
	face - Bold, Itali					
	settings, Highlight	hting, Specia	al symbols.			
	ng Paragraph style	е.				
2.6 Aligi	ng Paragraph style nments, Indents, I	e. Line Space, I	Margins,			
2.6 Aligi	ng Paragraph style	e. Line Space, I	Margins,			

8.1 Formatting Page 2 3.2 Page tab : Margins, Layout settings, Paper tray 3.3 Border & Shading 44 Columns 5.5 Header & Footer 3.6 Setting Footnotes & End notes 7.7 Shortcut Keys; Inserting manual page break, Column break and line break 8.8 Creating sections & frames 9.9 Anchoring & Wrapping 8.10 Printing Documents 4 Setting Document Styles 2 CO1 8.1 Table of Contents 2.1 Index 3.9 age Numbering 4.4 date & Time, Author, etc. 4.5 Creating Master Documents 6 Colournets 7 CO2 5.1 Table settings and Drawing - Inserting ClipArts, Pictures/Files etc., 2.8 Borders, Alignments, 3.1 Insertion, deletion, 4.4, Merging, Splitting, 5.5 Sorting, 6 Special Features 6 Special Features 6.5 Inserting Cliparts, pictures, objects, word art 5.3 Drawing: shapes, smart art, etc 5.4 Hyperlinks, bookmarks, cross-references, Digital Signature 7 Tools 7 Tools	3	Setting Page Style	4	CO1
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6 Special Features 6 CO2, CO3 6.1 Inserting Formula, equation, symbols 6 CO2, CO3 5.1 Inserting Formula, equation, symbols 5.2 Inserting Cliparts, pictures, objects, word art 5.3 Drawing: shapes, smart art, etc 5.4 Charts 5.4 Charts 5.5 Hyperlinks, bookmarks, cross-references, Digital Signature 7 Tools 7 CO2, CO3 7.1 Word Completion, Spell Checks, 7 CO2, CO3 7.3 Templates, 7 CO2, CO3 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks 5000kmarks, cross-references 7.5 Using Wizards 7 Co3 7.6 Tracking Changes, Security. Charcking Changes, Security. Reference Books 1.1 Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy	5.4 , Me	erging, Splitting,		
6 Special Features 6 CO2, CO3 5.1 Inserting Formula, equation, symbols 5.2 Inserting Cliparts, pictures, objects, word art 5.3 Drawing: shapes, smart art, etc 5.3 Drawing: shapes, smart art, etc 5.4 Charts 5.5 Hyperlinks, bookmarks, cross-references, Digital Signature 7 Tools 7 CO2, CO3 7.1 Word Completion, Spell Checks, 7 CO2, CO3 7.3 Templates, 7 CO2, CO3 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks 5000kmarks, cross-references 7.5 Using Wizards 7 Co3 7.6 Tracking Changes, Security. Certaing Changes, Security. Certaing Changes, Security. Reference Books 1 1 1 1 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2 1 2. Microsoft Word 365 2019 by Joan Lambert 1 1	5.5 Sort	ing,		
5.1 Inserting Formula, equation, symbols 5.2 Inserting Cliparts, pictures, objects, word art 5.3 Drawing: shapes, smart art, etc 5.4 Charts 5.5 Hyperlinks, bookmarks, cross-references, Digital Signature 7 Tools 7 Tools 7 CO2, CO3 7.1 Word Completion, Spell Checks, 7.2 Mail merge 7.3 Templates, 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks 5.5 Using Wizards 7.6 Tracking Changes, Security. Reference Books 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert	5.6 Form	nula		
 5.2 Inserting Cliparts, pictures, objects, word art 5.3 Drawing: shapes, smart art, etc 5.4 Charts 5.5 Hyperlinks, bookmarks, cross-references, Digital Signature 7 Tools 7 CO2, CO3 7.1 Word Completion, Spell Checks, 7.2 Mail merge 7.3 Templates, 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks 5.5 Using Wizards 7.6 Tracking Changes, Security. Reference Books 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert	6	Special Features	6	CO2, CO3
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7Tools7CO2, CO37.1 Word Completion, Spell Checks, 7.2 Mail merge7CO2, CO37.3 Templates, 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks bookmarks, cross-references7.5 Using Wizards7.5 Using Wizards7CO2, CO37.6 Tracking Changes, Security.7CO2, CO3Reference Books1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy2. Microsoft Word 365 2019 by Joan Lambert7	6.5 Hyp	erlinks, bookmarks, cross-references, Digital Signature		
 7.1 Word Completion, Spell Checks, 7.2 Mail merge 7.3 Templates, 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks pookmarks, cross-references 7.5 Using Wizards 7.6 Tracking Changes, Security. Reference Books 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert 	• •		7	CO2, CO3
 7.2 Mail merge 7.3 Templates, 7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks bookmarks, cross-references 7.5 Using Wizards 7.6 Tracking Changes, Security. Reference Books 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert 	7.1 Woi	d Completion, Spell Checks,		
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 7.5 Using Wizards 7.6 Tracking Changes, Security. Reference Books 1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert 				• •
 7.6 Tracking Changes, Security. Reference Books Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy Microsoft Word 365 2019 by Joan Lambert 				
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. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy 2. Microsoft Word 365 2019 by Joan Lambert				
2. Microsoft Word 365 2019 by Joan Lambert			by Jennife	r Duffv
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	J. IVIICI	Soft Hold 2015 Bloc by Lisa A Bucki		

Open Elective(OE)/General Elective(GE)

(*To be offered to faculty other than Science & Technology*) OE-102-DS-T : Introduction to Computers and Basics of Internet

No. of C	redits:	Teaching	Scheme	Exar	nination Scł	neme	
02		Practical:	2 Hrs/Week	Con	ontinuous Evaluation:15 Mark		
				End	Semester :	35 Marks	
Prerequ	isites			·			
• Basic I	knowledge of Co	mputer conce	epts is assumed.				
• Knowl	ledge of Compute	er as operatio	nal tool is require	ed.			
Objectiv	/es						
• To intr	oduce the fundation	mental conce	pts of computers				
• To intr	roduce the basic of	concepts of I	nternet				
• To dev	elop the ability t	o analyses an	d use the compu	ter periphe	erals effective	ely	
• To dev	elop the ability t	o analyses an	d use the interne	t effective	ly		
Course	Outcomes						
	pletion of this co						
	computer periphe		•				
	se the internet for	•	•				
	plore various ap		ailable over the ir	nternet.			
Unit		Name of	Unit		Teaching	CO Targeted	
No.					Hours		
1	Fundamentals				8	CO1	
	_		n, functionalities	of Compu	iter		
	erations and Class		-				
	tional Componer	-	outer				
	ications Of Com	-					
			, types of softwa		1 11700		
			systems-Window			~~~	
2	Introduction to	o various Co	mputer applicat	tions	6	CO1	
2.1 Vario	ous Explorers						
2.2 Edito	ors such as Notep	ad, wordpad					
2.3 Calcu	ulator, calendar,	etc					
2.4 Paint	•						
2.5 Vario	ous browsers						
2.6 Inter	net settings						
3	Basics of Inter	net			6	CO2	
3.1 Defin	nition and Histor	y of Internet					
3.2 Uses	and Application	a of Intornat					
5.2 0303	and Application	s of internet					

3.3 Definition of Web		
3.4 Website Address and URL		
3.5 Different types of Internet Connections:		
• Dial up Connection		
• Broad Band (ISDN, DSL, Cable)		
• Wireless (Wi-Fi, WiMax, Satellite, Mobile) naming co	nvention	
3.6 Modes of Connecting Internet (Hotspot, Wi-Fi, USB Tethe	ering)	
4 Browsers and Email	10	CO2
4.1 Search Engines		
4.2 Web Browsers		
Popular Web Browsers (Microsoft Edge, Google Chron	ne, Mozilla Fi	refox,Safari, etc.)
• Popular Search Engines.(Google, Bing, Startpage, Duck	DuckGo etc)
4.3 Portals		
4.4 Social Networking sites, blogs		
4.5 Using Browsers :		
• Viewing webpage		
 Downloading and uploading the website 		
4.6 E-mail:		
 Configuring an E-mail Account 		
 Composing and Sending Mail 		
 Receiving, Replying to and Forwarding Mail 		
• Attachments to email		
Reference Books		
1. Computer Fundamentals by P.K. Sinha & Priti Sinha, 3rd ed	lition, BPB pu	b.
2.Fundamental of Computers - By V. Rajaraman B.P.B. Public	cations	
3. The Internet Book by Douglas E Comer		
E-Books and Online Learning Material		
1 https://www.geeksforgeeks.org/computer-fundamentals-tute	orial/	

- 1. https://www.geeksforgeeks.org/computer-fundamentals-tutorial/
- 2. https://www.javatpoint.com/computer-fundamaentals

Semester-I

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-103-DS-T : Introduction to Google Apps I

No. of C	redits:	lits: Teaching Scheme Examination Scheme				neme	
02		Practical: 2 Hrs/Week			Continuous Evaluation:15 Marks		
				End	Semester :	35 Marks	
Prerequ	isites						
• Basic I	knowledge of Co	mputer conce	epts is assumed.				
• Know	edge of Compute	er as operatio	nal tool is requir	red.			
• Know	edge of Internet	is required					
Objectiv	ves						
To intro	luce the foundation	ons of variou	is Google tools.				
• To dev	elop the ability to	o analyses ar	nd use the tools e	ffectively			
Course	Outcomes						
On Com	pletion of this co	urse, student	will be able to -				
	se the Google too	•	•				
CO2: Ex	plore various app	plications ava	ailable in the goo	gle tools.			
CO3: De	evelop the skills t	<u> </u>		ble in the g	google tools.		
Unit		Name of	f Unit		Teaching	CO Targeted	
No.					Hours		
1	Gmail				2	CO1	
1.1 Conf	iguring an E-mai	l Account					
	posing and Sendi	0					
	iving, Replying t	o and Forwa	rding Mail				
	chments to email					1	
2	Google Drive				3	CO1, CO3	
2.1 Oper	ing the Drive						
2.2 Crea	ting folders, Goo	gle docs, Go	ogle sheets, Goo	gle slides			
2.3 Mana	aging Files and fo	olders					
2.4 Shari	ing files and folde	ers and mana	iging permission	S			
2.5 Dow	nloading the files	and folders					
2.6 Unlo	ading files and fo	olders					
2.0 Opio							
2.0 Opio 2.7 Print	ing files						
-	ing files Google Docs, S	heets and S	lides		8	CO1, CO2,CO3	
2.7 Print 3	-				8	CO1, CO2,CO	
2.7 Print 3 3.1 Crea	Google Docs, S	, sheets and s			8	CO1, CO2,CO	
2.7 Print 3 3.1 Creat 3.2 Form	Google Docs, S ting Google docs	, sheets and s ents	slides		8	<u> CO1, CO2,CO3</u>	

3.5 Spec	ial features in the docs, sheets and slides		
4	Google Forms	7	CO1, CO2.CO3
4.1 Creat	ing a Google form		·
4.2 Addi	ng various styles of the questions		
4.3 settin	gs of the Google form		
4.4 Creat	ing the links of the Google form and sharing the link		
4.5 Creat	ing and managing the permissions		
4.6 Mana	aging the data collected through Google form		
5	Other Google tools	10	CO2,CO3
5.1 Goog	gle Calendar		
5.2 Goog	gle Meet		
5.3 Goog	gle Chat		
5.4 Goog	gle Contacts		
5.5 Goog	gle Photos		
5.6 Goog	gle Maps		
Referen	ce Books		
1. Comp	lete Beginners guide to Google Apps Script by Daniel La	awrie.	
2.Google	e Apps made easy by James Bernstein		
3. My Go	oogle Apps by Sherry Kinkoph Gunter		

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-104-DS-T : Fundamentals of Computers I

No. of Credits:	Teaching Scheme	Examination Sc	heme		
02	Practical: 2 Hrs/Week	Continuous Eval	tinuous Evaluation:15 Marks		
		End Semester :	35 Marks		
Prerequisites					
Basic knowled	ge of Computer concepts is ass	umed.			
Objectives					
To converse with basic ter	rminology of computer				
• To understand basics of	Computer and working with C	perating System			
 To develop working ski 	lls with productivity enhancing	tools			
• To perform documentat	ion and accounting operations				
Course Outcomes					
On Completion of this con	urse, student will be able to -				
CO1: Understand the cond	cept of input and output devices	s of Computers			
CO2: Learn the functional	l units and classify types of con	nputers			
CO3: Understand concept	of software and working of op	erating system			
CO4: Learn basic Word p	rocessing, Spreadsheet and Pre	sentation Graphics S	oftware skills		
CO5: Study to use the Inf	ormation Technology safely, le	gally, and responsibl	У		
CO6: Describe various us	es of offices automation tools i	n accounting Operati	ons		
Unit	Name of Unit	Teaching	CO Targeted		
No.		Hours			
1 Introduction to	-	15	CO1,CO2,CO3		
1.1 Basics of Computers -	Definition, Block Diagram, Co	omputer Hierarchy, (Classification),		
Characteristics of Cor	nputer, Computer Memory Inpu	at and Output Device	s.		
1.2 Introduction to Softwa	are - Software Types - System S	Software, Application	n Software, Types		
of Operating Systems,	Functions of Operating System				
	Functions of Operating System vs Operating System:- Structur	ns.	ows Explorer, File		
1.3 Working with Window		ns. e of Windows, Wind	-		
1.3 Working with Window and Folder Operations	ws Operating System:- Structur	ns. e of Windows, Wind , Adding or Removir	ng New Programs		
1.3 Working with Window and Folder Operations using, Control Panel,	ws Operating System: - Structur s, The Search, The Recycle Bin	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad	g New Programs, and Calculator)		
1.3 Working with Window and Folder Operations using, Control Panel,	ws Operating System:- Structur s, The Search, The Recycle Bin Applications in windows (Paint s and Records, File Organizatio	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad	ng New Programs , and Calculator)		
 1.3 Working with Window and Folder Operations using, Control Panel, J Data Processing: Files 2 Office Automa 	ws Operating System:- Structur s, The Search, The Recycle Bin Applications in windows (Paint s and Records, File Organizatio	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad n (Sequential, Direct 15	ng New Programs , and Calculator) /Random, Index) CO4,CO5,CO6		
 1.3 Working with Window and Folder Operations using, Control Panel, J Data Processing: Files 2 Office Automa 2.1 Definition of Information 	ws Operating System:- Structur s, The Search, The Recycle Bin Applications in windows (Paint s and Records, File Organizatio tion Tools	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad n (Sequential, Direct 15	ng New Programs , and Calculator) /Random, Index) CO4,CO5,CO6		
 1.3 Working with Window and Folder Operations using, Control Panel, J Data Processing: Files 2 Office Automa 2.1 Definition of Information 	ws Operating System:- Structur s, The Search, The Recycle Bin Applications in windows (Paint s and Records, File Organizatio tion Tools tion Technology (IT) Benefits of nation Technology (IT)	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad n (Sequential, Direct 15	ng New Programs , and Calculator) /Random, Index) CO4,CO5,CO6		
 1.3 Working with Window and Folder Operations using, Control Panel, J Data Processing: Files 2 Office Automa 2.1 Definition of Informat Applications of Informat 2.2 Office Automation To 	ws Operating System:- Structur s, The Search, The Recycle Bin Applications in windows (Paint s and Records, File Organizatio tion Tools tion Technology (IT) Benefits of nation Technology (IT)	ns. e of Windows, Wind , Adding or Removir , Notepad, WordPad n (Sequential, Direct 15 of Information Techn	ng New Programs , and Calculator) /Random, Index) CO4,CO5,CO6 ology (IT)		

2.2.2 MS-Excel: Introduction, Starting MS-Excel, Basics of Spread sheet, MS-Excel Screen and its Components, Elementary Working with MS-Excel MS-PowerPoint: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS PowerPoint. **Reference Books** 1. Computer Fundamentals by: Anita Goel, Pearson Education India ISBN: 9788131742136 2. Connecting with Computer Science, by Greg Anderson, David Ferro, Robert Hilton, Course Technology, Cengage Learning, ISBN:9781439080351 3. Fundamentals of Computer : For undergraduate courses in commerce and management, ITL Education Solutions Limited, Pearson Education, ISBN:9788131733349 4. Introduction to Computer Science, 2/e, ITL Education Solutions Limited, Pearson Education, ISBN:9788131760307 5. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew B. Whinston, Pearson Education, ISBN: 9788177583922 6. Internet: The Complete Reference, Margaret Levine Young, Tata McGraw Hill Education Private Limited, ISBN: 9780070486997 7. On the Way to the Web: The Secret History of the Internet and Its Founders, A. Banks, Apress Publication, ISBN: 9781430208693 8. Computers and Commerce: A Study of Technology and Management at Eckert-Mauchly Computer Company, Engineering Research Associates, and Remingto, Arthur L. Norberg, MIT Press (MA), ISBN: 9780262140904 9. Essential of E-commerce technology by V. Rajaraman, Prentice Hall India Learning Private Limited ISBN 9788120339378 10. Fundamentals of Computers by E. Balagurusamy, McGraw Hill Computer Fundamentals by Priti Sinha, Pradeep K. Sinha, BPB Publications **Continuous Internal Evaluation – Max. Marks 15 Marks** (Min. Passing Marks: 06)(Min. Passing Percentage: 40% of Max. Marks) The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation: 1) Offline Written Examination 2) Power Point Presentations 3) Assignments / Tutorials 4) Oral Examination 5) Open Book Test 6) Offline MCQ Test 7) Group Discussion 8) Analysis of Case Studies Semester End Examination: Max. Marks 35 and Duration of Examination is 2 Hours (Min. Passing Marks: 14) (Min. Passing Percentage: 40% of Max. Marks)

Instructions:

- 1. Attempt all questions
- Q. 1. Fill in the Blanks on all Units (05 Marks)
- Q. 2. Theory Question on Unit-1 OR Unit-2 (08 Marks)
- Q. 3. Numerical Problem on Unit-1 OR Unit-2 (14 Marks)
- Q. 4. Write Short Notes on all Units (Any 2 out of 4) (08 Marks)

Detail Syllabus B.Sc. (Data Science) Semester-II

DS-151-T : Advanced Python Programming

INO. OF C	redits: 2	Teaching Scheme	Examination Sch	eme
		Theory:2 Hrs /Week	Continuous Evalu	ation:15 Marks
			End Semester:35 I	Marks
Prerequ	isites			
• F	undamentals o	of Python Programming Langua	.ge.	
• P	rior knowledge	e of computational mathematic	S.	
Objectiv	/es			
• T	o learn reading	g, writing and manipulating file	S	
• T	o implement	libraries like Pandas, NumP	y,SciPy, Matplotlib, Sc	cikit-learn etc. ir
Р	ython.			
• T	o implement t	he concepts of GUI controls an	d designing GUI applica	tions.
• 7	Fo learn and kr	now the concepts of file handlir	ng, exception handling.	
	Outcomes	-		
On Com	pletion of this	course, student will be able to -		
		id writing into files using Pytho		
	-	ement a program to solve a con		
		lementation of libraries like Pa		Matplotlib. Scikit-
	-			
iearn etc.	. in Python.			1 /
	. in Python. ow to handle ex	xceptions and files.		1 /
СО4: Но	ow to handle ex	xceptions and files. ement GUI application		L ,
СО4: Но	ow to handle ex		Teaching	CO Targeted
CO4: Ho CO5: De	ow to handle ex	ement GUI application		-
CO4: Ho CO5: De Unit	ow to handle ex	ement GUI application Name of Unit	Teaching	-
CO4: Ho CO5: De Unit No. 1	ow to handle exercises and imple	ement GUI application Name of Unit	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro	ow to handle exercises and imple File Handlin	ement GUI application Name of Unit	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1.1 Intro 1.2 Type	ow to handle exercises and imple File Handlin duction to File	ement GUI application Name of Unit g	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open	ow to handle exercises and imple File Handlin duction to File es of Files	ement GUI application Name of Unit g ng a Text File	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi	ow to handle exercises and imple File Handlin duction to File es of Files hing and Closir	ement GUI application Name of Unit g s ng a Text File ïle	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read	w to handle exercises and impleted by the second se	ement GUI application Name of Unit g ng a Text File Tile st File	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read 1.6 Settin	w to handle exercises and impleted by the second se	ement GUI application Name of Unit g ng a Text File Tile st File	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read 1.6 Settin	w to handle exercises and impleted on the second se	ement GUI application Name of Unit g s ng a Text File ïle xt File File File rsing a Text File	Teaching Hours	CO Targeted
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read 1.6 Settin 1.7 Creat	w to handle exercises and impleted by the set of the se	ement GUI application Name of Unit g ss ng a Text File ïle xt File File rsing a Text File rsing a Text File	Teaching Hours 3	CO Targeted CO1
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read 1.6 Settin 1.7 Creat 2 2.1 Intro	w to handle exercises and impleted on the second se	ement GUI application Name of Unit g s ng a Text File ïle xt File File File rsing a Text File	Teaching Hours 3	CO Targeted CO1
CO4: Ho CO5: De Unit No. 1 1.1 Intro 1.2 Type 1.3 Open 1.4 Writi 1.5 Read 1.6 Settin 1.7 Creat 2 2.1 Intro 2.1.1 Sta	w to handle exercises and impleted on the set of File Handlin duction to File ex of Files and Closir fing and Closir fing to a Text Filing from a Text fing from a Text fing and Traver of the set of	ement GUI application Name of Unit g s ng a Text File "ile xt File File rsing a Text File rsing a Text File aries thon Libraries	Teaching Hours 3	CO Targeted CO1

2.1.4 Deep Learning- TensorFlow,	Pytorch,	Keras
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2.1.5 Natural Language Processing (NLP)- NLTK, SpaCy, Gensim

2.2 Working with Tabular Numeric Data(Numpy with Python)

2.2.1 NumPy Arrays Creation Using array() Function

2.2.2 Array Attributes, NumPy Arrays Creation with Initial Placeholder Content

2.2.3 Integer Indexing, Array Indexing, Boolean ArrayIndexing, Slicing and Iterating in Arrays

Basic Arithmetic Operations on NumPy Arrays

2.2.4 Mathematical Functions in NumPy

2.2.5 Changing the Shape of an Array, Stacking and Splitting of Arrays, Broadcasting in Arrays.

2.3 Working with Data Series and Frames

2.3.1 Pandas Data Structures, Reshaping Data, Handling Missing Data

2.3.2 Combining Data, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O

2.4 Plotting

Basic Plotting with PyPlot, Matplotlib, Getting to Know Other Plot Types, Plotting with Pandas

3 Exception Handling	5	CO4
3.1 Python Exception		
3.2 Common Exception		
3.3 Exception handling in Python (try-except-else)		
3.4 The except statement with no exception		
3.5 Multiple Exception		
3.6 The try-finally clause		
3.7 Custom Exception and assert statement		
4 GUI Programming	5	CO5
4.1 Introduction		
4.2 Tkinter programming		
4.3 Tkinter widgets		
4.5 Frame		
4.6 Button		
4.7 Label		
4.8 Entry		
Reference Books		
1.Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010		
2.Dive into Python, Mike		
3. Learning Python, 4th Edition by Mark Lutz		
4. Programming Python, 4th Edition by Mark Lutz		
5.Python Programming: An introduction to computer, John Zelle, 3	Brd Edition.	
6. Data Science Essentials in Python: Collect, Organize, Ex	plore, Predic	et, Value. Dmitry
Zinoriev, The Pragmatic Programmers LLC, 2016		
7. Introduction to Python Programming. Gowrishankar S., Ve	ena A. CRC	Press, Taylor &
Francis Group, 2019		

DS-152-P : Lab Course on DS-151-T (Advanced Python Programming)

	credits: 2	Teaching Scheme	Examination Second	cneme	
		Practical: 4 Hrs/Week	Continuous Eva	luation: 15	Marks
			End Semester:	35	Marks
Prerequ	isites				
-		dge of Python Programming.			
		of computational mathematics.			
Objectiv		of computational mathematics.			
•		writing and manipulating files			
	0	braries like Pandas, NumPy	SciPy Matplotlib	Scikit-learn	etc i
	ython.	oraries like randas, rullin y	son y, mapiotilo,	beikit leurin	0.00.
	•	concepts of GUI controls and	designing GUI appli	cations.	
	-	w the concepts of file handling	0 0 11		
Course	Outcomes		×		
On Com	pletion of this co	ourse, student will be able to -			
CO1: Le	earn reading and	writing into files using Python			
CO2: D	esign and implen	nent a program to solve a comp	outational problem.		
	• •	mentation of libraries like Par	-	, Matplotlib,	Sciki
learn etc	. in Python.		• •	- '	
	•	eptions and files.			
CO4: H	ow to handle exc	eptions and files. Thent GUI application			
CO4: H	ow to handle exc	eptions and files. nent GUI application Name of Unit	Hours	CO Ta	rgeted
CO4: H CO5: De	ow to handle exc	nent GUI application	Hours	CO Ta	rgeted
CO4: He CO5: De Unit	ow to handle exc	nent GUI application Name of Unit	Hours 8	CO Ta	rgeted
CO4: He CO5: De Unit No. 1	ow to handle exc esign and implem File Handling	nent GUI application Name of Unit			rgeted
CO4: He CO5: De Unit No. 1 a. A	ow to handle exc esign and implem File Handling Assignments on re	nent GUI application Name of Unit eading and writing files	8		rgeted
CO4: He CO5: De Unit No. 1 a. A	ow to handle exc esign and implem File Handling Assignments on re	nent GUI application Name of Unit eading and writing files ccessing and manipulating file	8		rgeted
CO4: He CO5: De Unit No. 1 a. A b. A 2	ow to handle exc esign and implem File Handling Assignments on re Assignments on a Python Nump	nent GUI application Name of Unit eading and writing files accessing and manipulating file	8 s	CO1	rgeted
CO4: He CO5: De Unit No. 1 a. A b. A 2 a. A	w to handle exc esign and implem File Handling Assignments on re Assignments on a Python Nump	nent GUI application Name of Unit eading and writing files accessing and manipulating file y Numpy basics.	8 s	CO1	rgeted
CO4: He CO5: De Unit No. 1 a. A b. A 2 a. A b. A	ow to handle exc esign and implem File Handling Assignments on re Assignments on a Python Nump Assignments on N	nent GUI application Name of Unit eading and writing files ccessing and manipulating file y Numpy basics. Numpy Arrays.	8 s	CO1	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A 2 a. A b. A c. A	w to handle exc esign and implem File Handling Assignments on reassignments on a Python Nump Assignments on N Assignments on N	nent GUI application Name of Unit eading and writing files accessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra	8 s	CO1	rgeted
CO4: He CO5: De Unit No. 1 a. A b. A 2 a. A b. A c. A d. A	ow to handle exc esign and implem File Handling Assignments on re Assignments on a Python Numpy Assignments on N Assignments on N Assignments on N	hent GUI application Name of Unit eading and writing files ccessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics	8 s	CO1	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A c. A d. A e. A	ow to handle exc esign and implem File Handling Assignments on re Assignments on a Python Numpy Assignments on N Assignments on N Assignments on N Assignments on N	hent GUI application Name of Unit eading and writing files accessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics Numpy Strings	8 s 12	CO1	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A c. A d. A e. A 3	ow to handle exc esign and implem File Handling Assignments on re Assignments on a Python Numpy Assignments on N Assignments on N Assignments on N Assignments on N Assignments on N Assignments on N	nent GUI application Name of Unit eading and writing files ccessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics Numpy Statistics Sumpy Strings s	8 S 12 8	CO1	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A c. A d. A e. A 3 a	with the handle exclusion and implementation of the sector	hent GUI application Name of Unit Participation Name of Unit Participation Participation Numpy basics. Numpy basics. Numpy Linear Algebra Numpy Statistics Numpy Statistics Numpy Strings Son reading and writing text, CS	s 12 8 V files using Pandas	CO1	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A 2 a. A b. A c. A d. A e. A 3 a 4	File Handling File Handling Assignments on reassignments on a Python Numpy Assignments on N Assignments on N	hent GUI application Name of Unit eading and writing files accessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics Numpy Statistics Numpy Strings s on reading and writing text, CS thon	s S S S S S S S S S S S S S S S S S S S	CO1 CO2 CO3	rgeted
CO4: He CO5: De Unit No. 1 a. A b. A 2 a. A b. A c. A d. A e. A 3 a 4 a	File Handling File Handling Assignments on re Assignments on re Assignments on a Python Numpy Assignments on N Assignments on N	hent GUI application Name of Unit eading and writing files ccessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics Numpy Statistics Numpy Strings s on reading and writing text, CS thon on plotting graphs in python us	s SV files using Pandas I2 ing Matplotlib and P	CO1 CO2 CO3 CO3 yplot	rgeted
CO4: He CO5: Do Unit No. 1 a. A b. A 2 a. A b. A c. A d. A e. A 3 a 4	File Handling File Handling Assignments on re Assignments on re Assignments on a Python Numpy Assignments on N Assignments on N	hent GUI application Name of Unit Name of Unit eading and writing files accessing and manipulating file y Numpy basics. Numpy Arrays. Numpy Linear Algebra Numpy Statistics Numpy Statistics Numpy Strings s on reading and writing text, CS thon on plotting graphs in python us on Exception Handling	s S S S S S S S S S S S S S S S S S S S	CO1 CO2 CO3	rgeted

2.Dive into Python, Mike

3. Learning Python, 4th Edition by Mark Lutz

4. Programming Python, 4th Edition by Mark Lutz

5.Python Programming: An introduction to computer, John Zelle, 3rd Edition.

6. Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016

7. Introduction to Python Programming. Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019

DS-153-T : Discrete Probability and Probability Distributions

No. of C	Credits: 02	Teaching Scheme	Examination Sc	heme
		Theory: 2 Hours/Week	Continuous Eval	uation:15 Marks
			End Semester : 3	5 Marks
Prerequ	isites			
• I	Basics of Set the	eory, Mathematical operations		
Objectiv	ves			
•]	To revise the bas	sic concepts of probability, axion	natic theory of proba	bility.
•]	Fo understand th	ne concept of random variable		
•]	Го study probab	ility distribution (univariate and	bivariate) discrete ra	ndom variables,
e	expectation and	moments of probability distribution	ion	
•]	Fo find marginal	l distribution and conditional dist	ribution of bivariate	frequency
Ċ	listribution			
•]	Fo find condition	nal mean of bivariate frequency of	listribution	
•]	Fo find variance	, covariance and correlation of bi	ivariate frequency di	stribution
Course	Outcomes			
On Com	pletion of this c	course, student will be able to –		
CO1: Fi	nd the probabili	ties of events and its expectation	, mean, variance, etc	
CO2:Dis	stinguish betwee	en random and non-random expe	riments	
CO3:Ide	entify the nature	of distribution		
CO4: Fi	nd marginal dist	tribution and conditional distribu	tion	
CO5: Fi	nd mean of mar	ginal distribution and conditional	l mean of bivariate fi	requency
distribut	ion			
CO6: Fi	nd correlation o	f bivariate frequency distribution	l	
Unit		Name of Unit	Teaching	CO Targeted
No.			Hours	
1		ntroduction to Probability	07	CO1, CO2
Basics	of Probability			
		: Experiments/Models, Ideas o	of deterministic and	non-deterministi
	Random Experi	: Experiments/Models, Ideas o	f deterministic and	non-deterministic
models. Definiti	Random Experi ons: Sample s	: Experiments/Models, Ideas o iment. pace, Discrete sample space:	finite and countab	
models. Definiti Element	Random Experi ons: Sample s ary event, Com	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain even	finite and countab nt, Impossible event.	ly infinite, Event
models. Definiti Element Occurre	Random Experi ons: Sample s ary event, Comp ence of events	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain event concept of occurrence of a	finite and countab nt, Impossible event. an event. Algebra	ly infinite, Event of events and it
models. Definition Element Occurro represen	Random Experi ons: Sample s ary event, Comp ence of events tation in set the	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain events: Concept of occurrence of a ory notation. Occurrence of follo	finite and countab nt, Impossible event. an event. Algebra wing events (i) at lea	ly infinite, Event of events and it ast one of the give
models. Definition Element Occurro represent events, (Random Experi ons: Sample s ary event, Comp ence of events (ii) none of the g	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain events: Concept of occurrence of a ory notation. Occurrence of follo given events, (iii) all of the given	finite and countab nt, Impossible event. an event. Algebra wing events (i) at lea events, (iv) mutuall	ly infinite, Even of events and it ast one of the give y exclusive events
models. Definition Element Occurred represent events, ((v) mutu	Random Experi ons: Sample s ary event, Comp ence of events (ii) none of the g nally exhaustive	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain even s: Concept of occurrence of a ory notation. Occurrence of follo given events, (iii) all of the given events, (vi) exactly one event ou	finite and countab nt, Impossible event. an event. Algebra wing events (i) at lea events, (iv) mutuall t of the given events	ly infinite, Even of events and it ast one of the give y exclusive events
models. Definition Element Occurro represent events, ((v) mutu	Random Experi ons: Sample s ary event, Comp ence of events (ii) none of the g nally exhaustive	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain events: Concept of occurrence of a ory notation. Occurrence of follo given events, (iii) all of the given	finite and countab nt, Impossible event. an event. Algebra wing events (i) at lea events, (iv) mutuall t of the given events	ly infinite, Even of events and it ast one of the give y exclusive events
models. Definition Element Occurro represen events, ((v) mutu Classica	Random Experi ons: Sample s ary event, Comp ence of events (ii) none of the g ally exhaustive 1 definition of p	: Experiments/Models, Ideas of iment. pace, Discrete sample space: plement of an event, Certain even s: Concept of occurrence of a ory notation. Occurrence of follo given events, (iii) all of the given events, (vi) exactly one event ou	finite and countab nt, Impossible event. an event. Algebra wing events (i) at lea events, (iv) mutuall t of the given events	ly infinite, Event of events and it ast one of the gives y exclusive events

Axiomatic definition of probability. Theorems and results on probability with proofs based on axiomatic definition such $asP(AUB) = P(A) + P(B) - P(A \cap B)$. Generalization $P(AUBUC), 0 \le P(A) \le 1, P(A) + P(A') = 1, P(\Phi) = 0$ and when $A \subseteq B$ then $P(A) \le P(A) \le 1, P(A) + P(A') = 1, P(\Phi) = 0$ and when $A \subseteq B$ then $P(A) \le 1, P(A) + P(A') = 1, P(\Phi) = 0$ and when $A \subseteq B$ then $P(A) \le 1, P(A) + P(A') = 1, P(\Phi) = 0$ and when $A \subseteq B$ then $P(A) \le 1, P(A) + P(A') \le 1, P(\Phi) = 0$.

P(B).			
2	Conditional Probability	05	CO2
Definitio	n of conditional probability of an event. Results on con	ditional prob	ability. Definition
of indep	endence of two events $P(A \cap B) = P(A)P(B)$. Pairw	wise independ	dence and mutual
independ	lence for three events. Multiplication theorem	$P(A \cap B)$	= P(A) P(B A).
Generali	zation to $P(A \cap B \cap C)$. Partition of the sample	espace, prio	r and posterior
probabili	ities.Proof of Bayes' theorem. Applications of Bayes' the	eorem in reall	ife.
3	Univariate Probability Distributions and its	9	CO3
3	Mathematical Expectation	9	005
Univaria	ate Probability Distributions defined on Discrete	Sample Spa	ce: Concept and
definitio	n of a discrete random variable. Probability Mass F	unction (pmf) and cumulative
Distribut	ion Function (<i>cdf</i>), $F(\cdot)$ of discrete random variable	e, properties	of <i>cdf</i> . Mode and
median of	of a univariate discrete probability distribution.		
Mathem	natical Expectation: Definition of expectation (me	ean) of a m	random variable,
expectat	ion of a function of a random variable, Moment G	enerating Fu	nction (mgf) and
Cumulat	ive Generating Function (cgf). Properties of mgf and cgf.		
Definitio	ons of variance, standard deviation (SD) and Coefficient	of variation (CV) of univariate
probabili	ity distribution, effect of change of origin and scale	on mean, v	variance and SD.
Definitio	on of raw, central and factorial raw moments of univariat	te probability	Distributions and
their inte	prrelations (without proof). Coefficients of skewness and	kurtosis base	d on moments.
4	Mathematical Expectation for Bivariate	9	CO4, CO5,
	Frequency Distribution	-	CO6
	on of raw and central moments, mgf and cgf. Theorem		
product	of two jointly distributed random variables. Condition	nal expectation	on. Definitions of
	nal mean and conditional variance. Definition of covaria		
• •			
-	lence and uncorrelatedness of two variables. Varian	nce of linear	
-		nce of linear	
variables	lence and uncorrelatedness of two variables. Varian	nce of linear	
variables Referen	lence and uncorrelatedness of two variables. Variants, $Var(aX + bY)$, $Var(aX + bY + C)$ and its generalized	nce of linear zation.	combination of
variables Reference 1. C E	lence and uncorrelatedness of two variables. Variants, $Var(aX + bY)$, $Var(aX + bY + C)$ and its generalize Books Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Edition, Sultan Chand and Sons Publishers, New Delhi.	nce of linear zation. Mathematical	combination of Statistics, Eighth
variables Reference 1. C E 2. S	Hence and uncorrelatedness of two variables. Variants, $Var(aX + bY)$, $Var(aX + bY + C)$ and its generalize Books Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Edition, Sultan Chand and Sons Publishers, New Delhi. arma, K. V. S. (2001). Statistics Made it Simple: Do it y	nce of linear zation. Mathematical	Combination of Statistics, Eighth
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variables Reference 1. C E 2. S In 3. H Y 4. H P 5. M P	lence and uncorrelatedness of two variables. Varian A, Var(aX + bY), Var(aX + bY + C) and its generalized Books Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Edition, Sultan Chand and Sons Publishers, New Delhi. arma, K. V. S. (2001). Statistics Made it Simple: Do it yndia, New Delhi. Hoel, P. G. (1971). Introduction to Mathematical Statistic York. Hogg, R.V. and Craig, R.G.(1989). Introduction to Mathem Publishing Co., New York. Mayer, P. (1972). Introductory Probability and Statistical Publishing Co., London.	nce of linear zation. Mathematical yourself on Po cs, John Wile natical Statisti Applications	cs,Ed. MacMillan , Addison Wesley
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variables Reference 1. C 2. S 2. S 3. H 4. H 5. M 6. M 7. R 1. H 1. S 1. S 1. S 7. R	lence and uncorrelatedness of two variables. Varian A, Var(aX + bY), Var(aX + bY + C) and its generalized Books Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Edition, Sultan Chand and Sons Publishers, New Delhi. arma, K. V. S. (2001). Statistics Made it Simple: Do it yndia, New Delhi. Hoel, P. G. (1971). Introduction to Mathematical Statistic York. Hogg, R.V. and Craig, R.G.(1989). Introduction to Mathem Publishing Co., New York. Mayer, P. (1972). Introductory Probability and Statistical Publishing Co., London. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974) tatistics, Ed. 3, McGraw Hill Book Company. Rao, VLS Prakash (2008). First Course in Probability nternational Publishers, New Delhi.	nce of linear zation. Mathematical yourself on Po cs, John Wile natical Statisti Applications . Introduction ity and Stat	combination of Statistics, Eighth C. Prentce Hall of ey and Sons, New cs,Ed. MacMillan , Addison Wesley to the Theory of istics, New Age
variables Reference 1. C 2. S 2. S 3. H 3. H 4. H 5. M 6. M 7. R 8. R	lence and uncorrelatedness of two variables. Varian A, Var(aX + bY), Var(aX + bY + C) and its generalize Books Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Edition, Sultan Chand and Sons Publishers, New Delhi. arma, K. V. S. (2001). Statistics Made it Simple: Do it y india, New Delhi. Hoel, P. G. (1971). Introduction to Mathematical Statistic York. Hogg, R.V. and Craig, R.G. (1989). Introduction to Mathem Publishing Co., New York. Mayer, P. (1972). Introductory Probability and Statistical Publishing Co., London. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974) tatistics, Ed. 3, McGraw Hill Book Company. Rao, VLS Prakash (2008). First Course in Probability	nce of linear zation. Mathematical yourself on Po cs, John Wile natical Statisti Applications . Introduction ity and Stat	combination of Statistics, Eighth C. Prentce Hall of ey and Sons, New cs,Ed. MacMillan , Addison Wesley to the Theory of istics, New Age

DS-154-P : Lab Course on DS-153-T (Discrete Probability and Probability Distributions)

No. of C	Credits: 02	Teaching Scheme	Examination Scheme	
		Practical: 4 Hours/Week	Continuous Evaluation:	15 Marks
			End Semester : 35 Mar	ks
Prerequ	isites	.		
• I	Basics of Set the	eory, Mathematical operations		
Objectiv	ves			
		he concept of random variable		
	• •	bility distribution (univariate and		variables,
	-	moments of probability distribut		
		l distribution and conditional dist	ribution of bivariate freque	ency
	listribution			
		nal mean of bivariate frequency of		
		e, covariance and correlation of b	ivariate frequency distribut	ion
	Outcomes			
		course, student will be able to –		
		ities of events and its expectation		
	0	en random and non-random expe	riments	
	•	e of distribution		
	-	tribution and conditional distribu		
		ginal distribution and conditional	l mean of bivariate frequen	су
distribut				
	nd correlation c			
Sr.No.		of bivariate frequency distribution		
		List of Practical Assignm	ents	Hours
1			ents	Hours 4
	situations.	List of Practical Assignm f probability for different events b	ents based on real life	4
1 2	situations. Calculation of	List of Practical Assignm f probability for different events b f mathematical expectation and va	ents based on real life ariance.	
	situations. Calculation of Obtain margin	List of Practical Assignm f probability for different events b	ents based on real life ariance.	4
2 3	situations. Calculation of Obtain margin distribution	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of	ents based on real life ariance. f bivariate probability	4 4 4
2 3 4	situations. Calculation of Obtain margin distribution Calculation of	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con	ents based on real life ariance. f bivariate probability	4 4 4 4
2 3 4 5	situations. Calculation of Obtain margin distribution Calculation of Calculation of	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con f variance of linear combination.	ents based on real life ariance. f bivariate probability ditional variance	4 4 4 4 4 4
2 3 4	situations. Calculation of Obtain margin distribution Calculation of Calculation of Checking the	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con f variance of linear combination. independence of the probabilities	ents based on real life ariance. f bivariate probability ditional variance s of the events	4 4 4 4
2 3 4 5	situations. Calculation of Obtain margin distribution Calculation of Checking the Calculation of	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con f variance of linear combination.	ents based on real life ariance. f bivariate probability ditional variance s of the events	4 4 4 4 4 4
2 3 4 5 6 7	situations. Calculation of Obtain margin distribution Calculation of Checking the Calculation of distribution	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con f variance of linear combination. independence of the probabilities f the correlation coefficient based	ents pased on real life ariance. f bivariate probability ditional variance s of the events on bivariate probability	4 4 4 4 4 8
2 3 4 5 6	situations. Calculation of Obtain margin distribution Calculation of Checking the Calculation of distribution Model sampli	List of Practical Assignm f probability for different events b f mathematical expectation and va- nal and conditional distribution of f conditional expectation and con f variance of linear combination. independence of the probabilities	ents pased on real life ariance. f bivariate probability ditional variance s of the events on bivariate probability	4 4 4 4 4 4 4

Reference Books

- 1. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
- Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, New Delhi.
- 3. Hoel, P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
- 4. Hogg,R.V.and Craig, R.G.(1989).Introduction to Mathematical Statistics,Ed. MacMillan Publishing Co., New York.
- 5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
- 6. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
- 7. Rao, VLS Prakash (2008). First Course in Probability and Statistics, New Age International Publishers, New Delhi.
- 8. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing,Inc.

DS-155-T : Graph Theory

No. of C	redits: 2	Teaching Scheme Theory: 2 Hrs/Week	Examination Scheme Continuous Evaluation:	15 Marks		
		111001 <i>y</i> . 2 1110/ ((00K	End Semester :	35 Marks		
Prerequ	isites		L			
•	Basics of mathematics, Set Theory					
-	Objectives					
	• To introduce students about graph, graph models, types of graph, connectivity, applications of graph theory					
applications of graph theory.						
• To know how to find shortest path for different Eulerian and Hamiltonian circuit.						
	• To introduce students about Trees, applications of trees, binary tree, tree traversal, spanning trees.					
-	U	find minimum enonning tre	200			
		find minimum spanning tre		4 6.4		
	o make student	s familiar with the use of al	I these concepts as tools if	other areas of the		
	Outcomes					
		course, student will be able	to .			
-		raph, and graph models, ter				
	-	re examples on adjacency ar				
		tours and Hamiltonian cyc				
	•	the shortest spanning trees.	-			
	-	the problems on tournan				
Unit		Name of Unit	Teaching	CO Targeted		
No.			Hours			
No. 1	Graphs and	Graph Models	e	CO1, CO5		
1	-		Hours 4	CO1, CO5		
1 Graph: D	- Definition, basic	Graph Models	Hours 4 aph Models, Social networ	CO1, CO5 ks,		
1 Graph: D Commur	Definition, basic nication networ	Graph Models c terminology of Graph, Gra	Hours 4 aph Models, Social networ Software Design Application	CO1, CO5 ks,		
1 Graph: D Commur	Definition, basic nication networ	Graph Models c terminology of Graph, Gra ks, Information networks, Jo cs, Biological networks, Tou	Hours 4 aph Models, Social networ Software Design Application	CO1, CO5 ks,		
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1 Graph: D Commun Transpor 2 Handsha	Definition, basic nication network tation network Graph Isomo king lemma, Sp	Graph Models c terminology of Graph, Gra ks, Information networks, , s, Biological networks, Tou orphism	Hours4aph Models, Social networSoftware Design Applicationarnaments.5cted graph, Matrix represe	CO1, CO5 ks, ons, CO2		
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1Graph: DCommunTranspor2HandshaDefinitio3Walk, tra	Definition, basic nication network tation network Graph Isomo king lemma, Sp on of isomorphi Connected G ail, path, cycle,	Graph Models c terminology of Graph, Gra ks, Information networks, J cs, Biological networks, Tou orphism pecial Types of Graph, Dire sm,Examples on isomorphi araph	Hours4aph Models, Social networkSoftware Design Applicationarnaments.5cted graph, Matrix represesm of graphs.8cted graph, component, Cu	CO1, CO5 ks, ons, CO2 ntation of graph, CO3 t edge, Cut vertex,		
1Graph: DCommunTranspor2HandshaDefinitio3Walk, traCut set,	Definition, basic nication network tation network Graph Isomo king lemma, Sp n of isomorphi Connected G nil, path, cycle, Vertex connect	Graph Models c terminology of Graph, Gra ks, Information networks, J cs, Biological networks, Tou orphism pecial Types of Graph, Dire sm,Examples on isomorphi araph connected graph, disconnectivity, N	Hours4aph Models, Social networSoftware Design ApplicationInnaments.5cted graph, Matrix representsm of graphs.8cted graph, component, CutLinimal degree of a graph,	CO1, CO5 ks, ons, CO2 ntation of graph, CO3 t edge, Cut vertex, Relation between		
1Graph: DCommunTransport2HandshaDefinitio3Walk, traCut set,Vertex of	Definition, basic nication network tation network Graph Isomo king lemma, Sp n of isomorphi Connected G ail, path, cycle, Vertex connect connectivity, e	Graph Models c terminology of Graph, Gra ks, Information networks, Jo ss, Biological networks, Tou orphism pecial Types of Graph, Dire sm,Examples on isomorphi araph connected graph, disconnet	Hours4aph Models, Social networSoftware Design ApplicationInnaments.5cted graph, Matrix representsm of graphs.8cted graph, component, CutLinimal degree of a graph,	CO1, CO5 ks, ons, CO2 ntation of graph, CO3 t edge, Cut vertex, Relation between		
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1Graph: DCommunTranspor2HandshaDefinitio3Walk, traCut set,Vertex ofShortest4The Konalgorithm	Definition, basic nication network Graph Isomo king lemma, Sp on of isomorphi Connected G ail, path, cycle, Vertex connect connectivity, e path algorithm Eulerian and igsberg Seven n, Hamilton pat	Graph Models c terminology of Graph, Gra ks, Information networks, J cs, Biological networks, Tou orphism pecial Types of Graph, Dire sm,Examples on isomorphi araph connected graph, disconnectivity, M dge connectivity and Min , Dijkstra's algorithm Hamiltonian Graphs.	Hours4aph Models, Social networSoftware Design ApplicationSoftware Design Applicationarnaments.5cted graph, Matrix represesm of graphs.8cted graph, component, Culinimal degree of a graph,nimal degree of a graph5ch, Euler's circuit, Euleriantonian graph, Applications	CO1, CO5 ks, ons, CO2 ntation of graph, CO3 t edge, Cut vertex, Relation between ,Weighted graph, CO3 cO3 cO3		

5	Trees	8	CO4
Definit	ion of tree, basic terminology of tree, properties of trees,	Eccentricit	y of a vertex,
Centre,	diameter, radius of a tree, Spanning Tree, Chords and bran	nches of Sp	panning Tree,
Shortes	t spanning tree, Kruskal's algorithm, M-ary tree, binary tre	ee, Tree tra	versal, Ordered
rooted t	ree, polish notation, arborescence.		
Refere	nce Books		
1. Ke	nneth Rosen, Discrete Mathematics and It's Applications,	Tata McG	raw Hill, Seventh
Edi	ion.		
2. Na	rsingh Deo, Graph Theory with applications to computer s	cience and	engineering,
Pre	ntice Hall.		
2 Do	agle D. West Introduction to Creanh Theory Decrean Edu	action Sec	and adition

3. Dougals B. West, Introduction to Graph Theory, Pearson Education, Second edition.

Savitribai Phule Pune University B.Sc. Data Science (Pattern 2024) Semester-II DS-156-P : Lab Course on DS-155-T (Graph Theory)

		Teaching Scheme		Examination Scheme	
Credits:	2	Practical: 4 Hours/We	eek	Continuous Evaluation:	15 Marks
				End Semester :	35 Marks
Prerequi	sites				
• Ba	asics o	f mathematics, Set Th	eory		
Objectiv					
		01	graph models,	types of graph, connectivity,	applications of
• •	theory				
		-		ulerian and Hamiltonian circ	
		e students about Trees	, applications of	f trees, binary tree, tree trave	rsal, spanning
trees.			· ,		
		w to find minimum sp	-	· · · · · · · · · · · · · · · · · · ·	6.4
	ake stu se currio		e use of all these	e concepts as tools in other a	reas of the
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-			will be able to .		
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		d the graph, and graph an solve examples on			
CO2: Stu	idents c	an solve examples on	adjacency and	incidence matrix.	
CO2: Stu CO3: Ide	idents c entify th	an solve examples on e Euler tours and Har	adjacency and a niltonian cycle a		
CO2: Stu CO3: Ide CO4: Ab	idents c entify the le to Co	an solve examples on e Euler tours and Har ompute the shortest sp	adjacency and a niltonian cycle a anning trees.	incidence matrix. and find shortest path.	
CO2: Stu CO3: Ide CO4: Ab CO5: Stu	idents c entify the le to Co idents c	an solve examples on e Euler tours and Har	adjacency and niltonian cycle a anning trees. on tournamen	and find shortest path.	
CO2: Stu CO3: Ide CO4: Ab CO5: Stu CO6: Stu	idents c entify the le to Co idents c	an solve examples on e Euler tours and Har ompute the shortest sp an solve the problems an solve the problems	adjacency and niltonian cycle a anning trees. on tournamen on theory using	incidence matrix. and find shortest path. its and traffic flow. g Maxima Software.	
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Reference Books

- 1. Kenneth Rosen, Discrete Mathematics and It's Applications, Tata McGraw Hill, Seventh Edition.
- 2. Narsingh Deo, Graph Theory with applications to computer science and engineering, Prentice Hall.
- 3. Dougals B. West, Introduction to Graph Theory, Pearson Education, Second edition.

SEC-151-DS : Lab Course on Excel and Advanced Excel

	redits:	Teaching Scheme	Exa	nination Sch	neme
02		Practical: 4 Hrs/Wee	ek Con	tinuous Evalı	uation:15 Marks
			End	Semester :	35 Marks
Prerequ	isites				
•	Basic Comput	er Skills and Mathematic	rs Skill.		
Objectiv	ves				
•	To familiarize	the student in introducin	g and explorin	g MS excel.	
•	To provide dif	ferent ways of representation	ation and explo	ratory data a	nalysis in excel.
•	To prepare the	students to use excel in	their project w	orks	
•	Analyze data l	ike a professional.			
Course	Outcomes				
On Com	pletion of this co	urse, student will be able	e to -		
	-	amental concept of Micr			
CO2: Pe	rform calculation	s in excel and apply exce	el functions.		
	-	g charts and diagrams			
	• •	aphic presentations on st			
	rform various ad	vanced data tools and dat	ta analytics.		1
Unit		Name of Unit		Teaching	CO Targeted
No.				Hours	~~~
1		o Microsoft Excel		7	CO1
• Conc	cepts of Work bo	ok &Work sheets			
• Vario	ous Data Types				
VarioUsing	g different featur	es with data, Cell and Te			
VarioUsingInser	g different featur ting, Removing &	& Resizing of Columns &			
VarioUsingInserWorld	g different featur ting, Removing & king with Data ar	& Resizing of Columns & nd Ranges			
 Vario Using Inser Worl Enter 	g different featur ting, Removing & king with Data ar ring data into wo	& Resizing of Columns & nd Ranges rksheet			
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 Formatting Charts, 3D Graphs Advanced Graphing and Charting Formatting and customizing Pivot tables Using advanced options of Pivot tables, Pivot charts Line, Bar and Pie charts Scatter plots Histograms. 5 Analytics using Excel 7 CO5 	• Wha	t-if-Analysis- Goal Seek, Data Table		
4Advanced Graphing and Charting5CO3,CO4•Formatting and customizing Pivot tables•Using advanced options of Pivot tables, Pivot charts•Line, Bar and Pie charts•Scatter plots•Histograms.5Analytics using Excel7CO5	• Scer	ario Manager		
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 Using advanced options of Pivot tables, Pivot charts Line, Bar and Pie charts Scatter plots Histograms. 5 Analytics using Excel 7 CO5 	4	Advanced Graphing and Charting	5	CO3,CO4
 Line, Bar and Pie charts Scatter plots Histograms. 5 Analytics using Excel 7 CO5 	• Form	natting and customizing Pivot tables		
 Scatter plots Histograms. 5 Analytics using Excel 7 CO5 	• Usir	g advanced options of Pivot tables, Pivot charts		
Histograms. 5 Analytics using Excel 7 CO5	• Line	, Bar and Pie charts		
5Analytics using Excel7CO5	• Scat	ter plots		
	• Hist	ograms.		
Data analysis using normal chart	5	Analytics using Excel	7	CO5
- Duta anarysis asing normal chart	• Data	analysis using normal chart		
Regression in Excel	• Reg	ression in Excel		
Correlation, stddev, average, ANOVA	• Com	elation, stddev, average, ANOVA		
Reference Books	Referer	ce Books		
1. Mastering MS Excel: Functions and Formulas, Webtech (Khanna Publications)	1. Mas	tering MS Excel: Functions and Formulas, Webtech (Kha	anna Public	ations)
2. Microsoft Excel 2019 Data Analysis and Business Modeling, Wayne Winston, 2019	2. Mic	osoft Excel 2019 Data Analysis and Business Modeling,	Wayne Wi	nston, 2019
3. Advance Excel 2016, training Guide, By Ritu Arora	3. Adv	ance Excel 2016, training Guide, By Ritu Arora		

Open Elective(OE)/General Elective(GE)

To be offered to faculty other than Science & Technology OE-151-DS-T : Office Automation II

INO. OF C	redits:	Teaching	Scheme	Exan	nination Sch	neme
02		Practical:	2 Hrs/Week	Cont	inuous Evalu	uation:15 Marks
				End S	Semester :	35 Marks
Prerequi	isites					
• Previou	us knowledge of G	Computer co	oncepts is assumed.			
• Knowl	edge of Computer	r as operatio	nal tool is required.			
Objectiv	es					
• To intr	oduce the foundat	tions of offic	e automation espec	ially Pr	esentation Sl	kills.
• To dev	elop the ability to	prepare the	well formatted Pow	erPoin	t presentation	ns.
• To prep	pare the presentat	ions using P	owerPoint presentat	ion too	ls such as tal	oles, figures,
shapes, in	mages, audio, vide	eo etc.				
• To prep	pare the presentat	ions using a	dvanced automated	features	s such as anim	mation, slide
shows, et	c.					
Course (Dutcomes					
On Comp	pletion of this cou	irse, student	will be able to -			
CO1: Pre	pare the profession	onal presenta	ations			
CO2: Exp	plore various tool	s in the Pow	erPoint presentation	softwa	are	
CO3: De	velop documents	using Power	Point advanced tool	ls		
Unit		Name of	Unit		Teaching	CO Targeted
No.					Hours	
1	Introduction to	Presentatio	on		5	CO1
1.1. Oper	ning new presenta	tion,				
	rant presentation					
1.2. Diffe	erent presentation	templates,				
	ng backgrounds,	templates,				
1.3. Setti	-	-				
1.3. Setti	ng backgrounds,	layouts	Presentation		8	CO1
1.3. Settin 1.4. Selec 2	ng backgrounds, cting presentation	layouts	Presentation		8	CO1
1.3. Setti 1.4. Selec 2 2.1 Prese	ng backgrounds, cting presentation Creating and F	layouts ormatting H	Presentation		8	CO1
1.3. Setti 1.4. Selec 2 2.1 Prese	ng backgrounds, cting presentation Creating and F ntation style, ng text to the Pres	layouts ormatting H	Presentation		8	CO1
1.3. Setti 1.4. Select 2 2.1 Prese 2.2 Addin 2.3 Addin	ng backgrounds, cting presentation Creating and F ntation style, ng text to the Pres	layouts ormatting H	Presentation		8	CO1
1.3. Setti 1.4. Select 2 2.1 Prese 2.2 Addin 2.3 Addin 2.4 Color	ng backgrounds, cting presentation Creating and F ntation style, ng text to the Pres ng style	layouts ormatting H	Presentation		8	CO1
1.3. Setti 1.4. Select 2 2.1 Prese 2.2 Addin 2.3 Addin 2.4 Color 2.5 Arran	ng backgrounds, eting presentation Creating and F ntation style, ng text to the Preseng style ur, gradient fills	a layouts ormatting I sentation.	Presentation		8	CO1
1.3. Setti 1.4. Select 2 2.1 Prese 2.2 Addin 2.3 Addin 2.4 Color 2.5 Arran 2.6 Addin	ng backgrounds, cting presentation Creating and F ntation style, ng text to the Pres ng style ur, gradient fills nging objects	a layouts ormatting I sentation.	Presentation		8	CO1
1.3. Setti 1.4. Select 2 2.1 Prese 2.2 Addin 2.3 Addin 2.4 Color 2.5 Arran 2.6 Addin	ng backgrounds, cting presentation Creating and F ntation style, ng text to the Preseng style ur, gradient fills nging objects ng Header & Foot Background, Slice	a layouts ormatting I sentation. ter le layout	Presentation ts to Presentation		8	CO1 CO1,CO2

3.2. Drav	ving Pictures using Draw		
3.3. Setti	ng Animation		
3.4 Tran	sition Effect		
4	Printing and showing a presentation	5	CO2, CO3
4.1 Print	ing Handouts		
4.2 Gene	rating Standalone Presentation viewer		
4.3 Prese	enting the presentation using various styles		
Referen	ce Books		
1. Micro	soft PowerPoint by James Holler		
2. Power	Point for dummies, office 2021 Edition Doug Lowe		
3. Learn	Microsoft Office 2019 by Linda Foulkes		

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-152-DS-T : Computer Fundamentals

No. of C	redits:	Teaching Scheme	Examination Sch	neme
02		Practical: 2 Hrs/Week	Continuous Eval	uation: 15 Marks
			End Semester :	35 Marks
Prerequ	isites			
• Basic l	knowledge of C	omputer concepts is assumed.		
• Knowl	edge of Compu	ter as operational tool is required	l.	
Objectiv	/es			
To introd	luce the fundam	ental concepts of computers.		
• To stu	dy the basics of	Computer System		
• To intr	roduce the comp	outer peripherals and other device	es	
• To lea	arn how to confi	gure computer devices		
• To Lea	arn Basic Comm	ands of Operating system and ap	oplication software	
Course	Outcomes			
On Com	pletion of this co	ourse, student will be able to -		
CO1: U	se the computer	s for the day to day life		
CO2: Le	earn the fundam	ental concepts of computer scien	ice	
CO3: Ex	xplore various a	pplications available in the comp	outers	
CO4: Ex	xplain the needs	of hardware and software requir	ed for a computation	task
Unit		Name of Unit	Teaching	CO Targeted
No.			Hours	
1	Introduction	to Computers	7	CO1,CO2
1.1 Intro	duction, Charac	teristics of Computers,		
1.2 Bloc	k diagram of co	mputer		
	puter Generation			
	•			
1.4 Type	s of computers	and features- Mini Computers, M	licro Computers, Ma	inframe
1.4 Type Com	s of computers a puters, Super Co	and features- Mini Computers, Momputers, Laptops and Tablets	-	
1.4 Type Com	s of computers a puters, Super Co	and features- Mini Computers, M	-	
1.4 Type Com 1.5 Type Lang	s of computers a puters, Super Co s of Programmi uages	and features- Mini Computers, Momputers, Laptops and Tablets ng Languages- Machine Langua	ges, Assembly Langu	ages, High Level
1.4 Type Com 1.5 Type	s of computers a puters, Super Co s of Programmi uages	and features- Mini Computers, Momputers, Laptops and Tablets	-	
1.4 Type Com 1.5 Type Lang 2	s of computers a puters, Super Co s of Programmi uages Introduction	and features- Mini Computers, Momputers, Laptops and Tablets ng Languages- Machine Langua	ges, Assembly Langu	ages, High Level
1.4 Type Com 1.5 Type Lang 2 2.1 Prim	s of computers a puters, Super Co s of Programmi uages Introduction ary And Second	and features- Mini Computers, Momputers, Laptops and Tablets ng Languages- Machine Langua to Computer Peripherals	ges, Assembly Langu	ages, High Level
1.4 Type Com 1.5 Type Lang 2 2.1 Prim 2.2 Prim	s of computers a puters, Super Co s of Programmi uages Introduction ary And Second ary storage devi	and features- Mini Computers, Momputers, Laptops and Tablets ng Languages- Machine Langua to Computer Peripherals ary storage devices	ges, Assembly Langu	ages, High Level
1.4 Type Com 1.5 Type Lang 2 2.1 Prim 2.2 Prim 2.3 Seco	s of computers a puters, Super Co s of Programmi uages Introduction ary And Second ary storage devi ndary Storage D	and features- Mini Computers, Momputers, Laptops and Tablets ng Languages- Machine Langua to Computer Peripherals ary storage devices ces – RAM, ROM, PROM, EPR	ges, Assembly Langu 8 .OM	ages, High Level
1.4 Type Com 1.5 Type Lang 2 2.1 Prim 2.2 Prim 2.3 Seco 2.4 I/O I	s of computers a puters, Super Co s of Programmi uages Introduction ary And Second ary storage devi ndary Storage D Devices- Scanne	and features- Mini Computers, Monputers, Laptops and Tablets ng Languages- Machine Langua to Computer Peripherals ary storage devices ces – RAM, ROM, PROM, EPR Devices - CD, HD, Pen drive	ges, Assembly Langu 8 .OM	ages, High Level

2.1 Inter bestien to Diverse Merchan Contents		
3.1 Introduction to Binary Number System		
3.2 Introduction to Octal Number System		
3.3 Introduction to Hexadecimal Number System		
3.4 Addition, Subtraction, Multiplication, Division		
4 Operating Systems	4	CO2,CO3
4.1 Definition of Operating System		
4.2 Functions of Operating System		
4.3 Role of Operating System		
4.4 Types of Operating System		
5 Introduction to Computer Networking	5	CO3,CO4
5.1 Network definition Common terminologies: LAN, WAN, No	de, Host, V	Vorkstation,
bandwidth, Interoperability		
5.2 Network Administrator,		
5.3 Network Security		
5.4 Network Components: Severs, Clients		
1.1 Communication Media		
5.6 Types of network: Peer to Peer, Clients Server		
Reference Books		
1. Computer Fundamentals by P.K. Sinha & Priti Sinha, 3rd edition	on, BPB pu	b.
2.Fundamental of Computers – By V. Rajaraman B.P.B. Publicat	ions	
3. Computer Networks – By Tennenbum Tata MacGrow Hill Pub	olication	
E-Books and Online Learning Material		
3. https://www.geeksforgeeks.org/computer-fundamentals-tutoria	ıl/	
4. https://www.javatpoint.com/computer-fundamaentals		

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-153-DS-T : Introduction to Google Apps II

No. of C	redits:	Teaching	Scheme	Exar	nination Scl	neme	
02		Practical:	2 Hrs/Week	Con	tinuous Evaluation: 15 Mark		
				End	Semester :	35 Marks	
Prerequ	isites						
• Basic l	knowledge of Co	mputer conce	epts is assumed.				
• Knowl	edge of Comput	er as operatio	nal tool is require	d.			
• Knowl	edge of Internet	is required					
Objectiv	ves						
• To intr	oduce the specia	lized Google	tools.				
• To dev	elop the ability t	to analyses an	d use the tools ef	fectively	and skilfully		
Course	Outcomes						
-	pletion of this co						
	e the google too	-	-				
		-	ilable in the Goo				
	velop the skills t	1	the skills availabl	e in the C	Google tools	1	
Unit		Name of	Unit		Teaching	CO Targeted	
No.					Hours		
1	Creating You	Tube Chann	el		10	C01,C02,C03	
1.1 Creat	ting a you tube c	hannel					
	aging the channe	-					
	ading the videos	on the chann	el				
	Streaming						
2	Creating a we	bsite			10	CO1,CO2,CO3	
2.1 Creat	ting a website						
2.2 Mana	aging home page	;					
2.3 Creat	ting Menus on th	e website					
2.4 Addi	ng pages to the s	site					
2.5 Settin	ng up themes						
2.6 Addi	ng tools such as	tables, placeh	olders, hyper link	king, butte	ons, maps, et	c	
2.7 Publi	shing a site						
3	Google Classr	oom			10	CO1,CO2,CO3	
3.1 Creat	ting Google class	sroom					
3.2 Creat	ting a class						
3.3 Strea	ming a class						
	ining a class						

- 3.5 Adding class work : assignments, quiz, question, material, etc
- 3.5 Giving grades to the assignments
- 3.6 joining a class (from student side)

Reference Books

- 1. Complete Beginners guide to Google Apps Script by Daniel Lawrie.
- 2.Google Apps made easy by James Bernstein
- 3. My Google Apps by Sherry Kinkoph Gunter

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-154-DS-T : Fundamentals of Computers II

No. of C	redits:	Teaching	Scheme	Exai	nination Sch	eme
02		Practical:	2 Hrs/Week	Con	tinuous Evalı	ation:15 Marks
				End	Semester :	35 Marks
Prerequi	isites					
٠	Basic knowledg	ge of Compu	ater concepts is assur	ned		
Objectiv	es					
To build	an understanding	of the funda	amental concepts of	compu	ter networkir	ng.
			asic terminology of		-	•
• To und	lerstand computer	network teo	chnology with variou	ıs devi	ces independ	ently.
• To iden	ntify the different	types of net	work topologies and	proto	cols.	
Course (Dutcomes					
-	pletion of this cou					
CO1: UI	nderstand the basi	c concepts o	of Networking and C	yber S	ecurity	
	•	•	and concepts of Digi	-		
	•	• •	etwork devices and			in a Network
			and related terms of	Interne	et	
	valuate informatio					r
Unit		Name of	f Unit		Teaching	CO Targeted
No.					Hours	
1		o Comput	ters Network and	I E-	15	CO1,CO3,CO4
	Commerce					
	1		rking Computer Net			MAN) Network
		U U	, Gateway, Router, M		,	
			vork Internet and Inte			
		-	ernet, Use of Internet	, Over	view of wor	la wide web
-	Server and Clien					
			Fi, Uses of Wi-Fi			
	by Share : Applic				15	CO1 CO2 CO4
2	Introduction to	Internet &	Cyber Security		15	CO1,CO2,CO4, CO5
21 Conc	ant of Internet In	tornat Carri	ce Providers(ISP), Se	orvioor	Drovidad by	
	il, Search Engine		$c = r_1 \cup v_1 \cup c_1 s(1), s(1)$	ervices	s i tovided by	
	, e	verview R	ackground and curre	nt coe	nario Tunes o	f Attacks Goals
of sec	•	$\mathbf{v} = \mathbf{v} = \mathbf{D}$	ackground and curre	in see	inario rypes o	1 1 macks, 00als
	•	hreats Weal	k / Strong passwords	and n	assword crack	king Insecure
2.5 0 101		incais, wea	x, shong passwords	and p		king, mocure

Network connections, Digital Signature.

2.4 Cyber Security: Cybersecurity definition, Cybercrime: Classification of Cybercrime:a)Email spoofing b) Spamming c) Identity Theft d) Online Fraud e) ATM Skimming f)Credit Card Fraud

2.5 Overview of Indian Information Technology Act 2002

Reference Books

1. Computer Fundamentals by: Anita Goel, Pearson Education India ISBN: 9788131742136

2. Connecting with Computer Science, by Greg Anderson, David Ferro, Robert Hilton, Course Technology, Cengage Learning, ISBN:9781439080351

3. Fundamentals of Computer : For undergraduate courses in commerce and management, ITL Education Solutions Limited, Pearson Education, ISBN:9788131733349

4. Introduction to Computer Science, 2/e, ITL Education Solutions Limited, Pearson Education, ISBN:9788131760307

5. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew B. Whinston, Pearson Education, ISBN:9788177583922

6. Internet: The Complete Reference, Margaret Levine Young, Tata McGraw Hill Education Private Limited, ISBN: 9780070486997

7. On the Way to the Web: The Secret History of the Internet and Its Founders, A. Banks, Apress

Publication, ISBN: 9781430208693

8. Computers and Commerce: A Study of Technology and Management at Eckert-Mauchly Computer Company, Engineering Research Associates, and Remingto, Arthur L. Norberg, MIT Press (MA),ISBN:9780262140904

9. Essential of E-commerce technology by V.Rajaraman, Prentice Hall India Learning Private Limited ISBN 9788120339378

10. Fundamentals of Computers by E. Balagurusamy, McGraw Hill

11. Computer Fundamentals by Priti Sinha, Pradeep K. Sinha, BPB Publications

12. Computer Networks - Andrew Tanenbaum (III Edition)

13. Complete Guide to Networking - Peter Norton

14. Data Communications & Networking - Behrouz Ferouzan (III Edition)

15. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Nina Godbole, Sunit Belapure, Wiley: April 2011 India Publications Released.

16. Cyber Security Essentials- James Graham Richard Howard Ryan Olson Indian Information Technology Act 2002

Continuous Internal Evaluation – Max. Marks 15 Marks

(Min. Passing Marks: 06)(Min. Passing Percentage: 40% of Max. Marks)

The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation:

- 1) Offline Written Examination
- 2) PowerPoint Presentations
- 3) Assignments / Tutorials
- 4) Oral Examination
- 5) Open Book Test
- 6) Offline MCQ Test
- 7) Group Discussion
- 8) Analysis of Case Studies

Semester End Examination: Max. Marks 35 and Duration of Examination is 2 Hours (Min. Passing Marks: 14)(Min. Passing Percentage: 40% of Max. Marks)

Instructions: 1.

Attempt all questions

Q. 1. Fill in the Blanks on all Units (5 Marks)

Q. 2. Theory Question on Unit-1 OR Unit-2 (8 Marks)

Q. 3. Numerical Problem on Unit-1 OR Unit-2 (14 Marks)

Q. 4. Write Short Notes on all Units (Any 2 out of 4) (8 Marks)

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-155-DS-T : Introduction to Data Science

	redits: 02	Teaching Scheme	Examination Sch	neme
		Practical: 2 Hrs/Week	Continuous Evalu	uation: 15 Marks
			End Semester :	35 Marks
Prerequ	isites			
•	Basic knowl	edge of Computer concepts is as	sumed	
Objectiv	ves			
To build	an understandi	ng of the fundamental concepts	of computer networkin	ng.
• To u	inderstand need	l of Data Science		
• To F	Know role of St	atistics in Data Science		
• To k	now Data Scie	nce Models and Tasks		
Course (Outcomes			
On Com	pletion of this c	course, student will be able to -		
CO1: D	efine Data Scie	nce Tasks and Models and Lifec	eycle	
CO2: A	pply Pre-proces	ssing and visualization Techniqu	es\	
Unit		Name of Unit	Teaching	CO Targeted
No.			Hours	
1	Introduction		6	CO1
What and	d why. Why lea	arn Data Science?, Types of Data	a -structured, semi-stru	ictured,
unstructu	red Data			
		cience, The Data Science Lifecyc		
Data sou	rces-Open Data	a Social Media Data Multimode	al Data, standard datas	sets
Dulu bou				
2	Statistics for	Data Science	6	CO1
2				
2 Data Obj	jects and Attrib	Data Science	Binary, Ordinal Attrib	butes,
2 Data Obj Numeric	jects and Attrib	Data Science utes, Attribute Types: Nominal,	Binary, Ordinal Attrib	butes,
2 Data Obj Numeric Science	jects and Attrib Attributes, Dis	Data Science utes, Attribute Types: Nominal,	Binary, Ordinal Attrib tes, Role of statistics i	putes, n Data
2 Data Obj Numeric Science Descripti	ects and Attrib Attributes, Dis	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo	Dutes, n Data ency:
2 Data Obj Numeric Science Descripti Mean, M	ects and Attrib Attributes, Dis	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu Measuring the Frequency, Measu de, Measuring the Dispersion: R	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo	Dutes, n Data ency:
2 Data Obj Numeric Science Descripti Mean, M	ects and Attrib Attributes, Dis ive statistics - M ledian, and Mo	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu Measuring the Frequency, Measu de, Measuring the Dispersion: R	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo	Dutes, n Data ency:
2 Data Obj Numeric Science Descripti Mean, M Variance 3	ects and Attrib Attributes, Dis ive statistics - N ledian, and Mo , Inter quartile Data science	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu Measuring the Frequency, Measu de, Measuring the Dispersion: R Range	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo ange, Standard deviati	Dutes, n Data ency: ion,
2 Data Obj Numeric Science Descripti Mean, M Variance 3 Predictiv	iects and Attrib Attributes, Dis ive statistics - M ledian, and Mo , Inter quartile Data science re and Descript:	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu Measuring the Frequency, Measu de, Measuring the Dispersion: R Range Models and Tasks ive Models, Introduction to Data	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo ange, Standard deviati	outes, n Data ency: ion, CO1
2 Data Obj Numeric Science Descripti Mean, M Variance 3 Predictiv Classific	jects and Attrib Attributes, Dis ive statistics - N ledian, and Mo , Inter quartile Data science re and Descript: ation, Predictio	Data Science utes, Attribute Types: Nominal, screte versus Continuous Attribu Measuring the Frequency, Measu de, Measuring the Dispersion: R Range Models and Tasks ive Models, Introduction to Data on, Association, Clustering, Perfo	Binary, Ordinal Attrib tes, Role of statistics i uring the Central Tendo ange, Standard deviati	outes, n Data ency: ion, CO1
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Data Cle	aning - Missing Values, Noisy Data		
Data Tra	nsformation – Rescaling, Normalizing,		
Data red	uction and Data discretization		
5	Data Visualization	6	CO2
Introduct	ion to Exploratory Data Analysis (EDA), Data visualiza	tion,	
Basic dat	a visualization tools -Box Plots, Histograms, Bar charts	/graphs, Scat	tter
plots, Lii	ne charts, Area plots, Pie charts		
Referen	ce Books		
1. Data	Science Fundamentals and Practical Approaches, Gypsy	Nandi, Rup	am
Sharı	na, BPB Publications, 2020.		
2. Data	Mining Concepts and Techniques, Third Edition, Jiawei	Han, Miche	line
Kam	ber, Jian Pei, Morgan Kaufmann, 2012.		
3. A Ha	nds-On Introduction to Data Science, Chirag Shah, Univ	versity of Wa	shington
Cam	oridge University Press		

Open Elective(OE)/General Elective(GE)

(To be offered to faculty other than Science & Technology) OE-156-DS-T: AI Tools for Business

110. UI CI	redits: 02	Teaching	Scheme	Exan	nination Sch	eme
		Practical:	2 Hrs/Week	Cont	tinuous Evalu	uation:15 Marks
				End S	Semester :	35 Marks
Prerequi	sites	1				
•	Basic knowled	ge of Compu	uter concepts is as	sumed		
Objectiv	es					
To build	an understanding	of the funda	amental concepts of	of comput	ter networkin	ng.
• To in	ntroduce students	to AI applic	cations in business			
 To fa maki 		ts with popu	lar AI tools for au	tomation,	marketing, a	and decision-
• To d	evelop hands-on	skills in usir	ng AI-driven busin	ess soluti	ions	
Course C	Dutcomes					
On Comp	oletion of this cou	urse, student	will be able to -			
CO1: Ur	nderstand the role	e of AI tools	in business operat	ions		
CO2: Ut	ilize AI-powered	tools for ma	arketing, automation	on, and de	ecision-maki	ng
CO3: Ap	pply AI solutions	to business	challenges throug	n practica	l use cases	
Unit		Name of	f Unit		Teaching	CO Targeted
No.					Hours	
1	Introduction to	AI in Busin	ness		5	CO1
1.1 Basic	cs of Artificial In	telligence (A	AI) and Machine L	earning (ML)	
	cs of Artificial In of AI in Busines	-		earning (ML)	
1.2 Role	of AI in Busines	s Decision N		-		
1.2 Role 1.3 AI-p	of AI in Busines	s Decision M Automation	Making 1: Advantages & C	-		<u> </u>
1.2 Role 1.3 AI-p 1.4 Intro	of AI in Busines owered Business duction to AI Etl	s Decision M Automation nics and Bias	Making 1: Advantages & C	hallenges	3	
1.2 Role 1.3 AI-p 1.4 Intro	of AI in Busines owered Business duction to AI Etl Study: AI Imple	s Decision M Automation nics and Bias mentation ir	Making 1: Advantages & C 5	hallenges Banking	3	CO2
1.2 Role 1.3 AI-p 1.4 Intro 1.5 Case 2	of AI in Busines owered Business duction to AI Etl Study: AI Imple AI-Powered To	Automation M Automation nics and Bias mentation ir pols for Proc	Making n: Advantages & C s n E-commerce and	hallenges Banking nation	Sectors 10	
1.2 Role 1.3 AI-p 1.4 Intro 1.5 Case 2 2.1 AI for	of AI in Business owered Business duction to AI Eth Study: AI Imple AI-Powered To r Communication	Automation Automation nics and Bias mentation ir pols for Proc a & Content	Making Advantages & C Advantages & C Advantages Ad	hallenges Banking nation T, Google	Sectors 10	
1.2 Role 1.3 AI-p 1.4 Intro 1.5 Case 2 2.1 AI for	of AI in Business owered Business duction to AI Eth Study: AI Imple AI-Powered To r Communication r Meetings & Tra	Automation Automation nics and Bias mentation ir pols for Proc a & Content anscription: (Making a: Advantages & C s a E-commerce and ductivity & Autor Creation: ChatGP	hallenges Banking nation T, Google	Sectors 10	
1.2 Role 1.3 AI-pu 1.4 Intro 1.5 Case 2 2.1 AI for 2.2 AI for 3	of AI in Busines owered Business duction to AI Eth Study: AI Imple AI-Powered To r Communication r Meetings & Tra AI in Marketin	Automation M Automation nics and Bias mentation ir pols for Proc a & Content anscription: (ag & Custon	Making a: Advantages & C a E-commerce and luctivity & Autor Creation: ChatGP Otter.ai, Fireflies.a ner Engagement	hallenges Banking nation T, Google	Sectors 10 e Bard, Gram 8	nmarly, Canva AI
1.2 Role 1.3 AI-p 1.4 Intro 1.5 Case 2 2.1 AI for 2.2 AI for 3 3.1 AI for	of AI in Business owered Business duction to AI Eth Study: AI Imple AI-Powered To r Communication r Meetings & Tra AI in Marketin r Digital Marketi	Automation Automation nics and Bias mentation ir ools for Proc a & Content anscription: (g & Custon ng & SEO: (Making a: Advantages & C s a E-commerce and ductivity & Autor Creation: ChatGP Otter.ai, Fireflies.a	hallenges Banking nation T, Google i , SurferSl	Sectors 10 e Bard, Gram 8 EO	nmarly, Canva AI CO1, CO2
1.2 Role 1.3 AI-p 1.4 Intro 1.5 Case 2 2.1 AI for 2.2 AI for 3 3.1 AI for	of AI in Business owered Business duction to AI Eth Study: AI Imple AI-Powered To r Communication r Meetings & Tra AI in Marketin r Digital Marketi	Automation M Automation nics and Bias mentation ir ools for Proo a & Content unscription: (g & Custon ng & SEO: (ed Customer	Making a: Advantages & C a E-commerce and ductivity & Autor Creation: ChatGP Otter.ai, Fireflies.a ner Engagement Copy.ai, Jasper AI	hallenges Banking nation T, Google i , SurferSl	Sectors 10 e Bard, Gram 8 EO	nmarly, Canva AI CO1, CO2

4.2 Predictive Analytics & Decision Making: AI in Finance & Risk Analysis

Reference Books

- 1. Artificial Intelligence in Business: Opportunities and Challenges" Péter Szeredi & Attila Kiss
- 2. AI Superpowers: China, Silicon Valley, and the New World Order" Kai-Fu Lee
- 3. The AI Advantage: How to Put the Artificial Intelligence Revolution to Work" Thomas H. Davenport
- 4. 4Human + Machine: Reimagining Work in the Age of AI" Paul R. Daugherty & H. James Wilson
- 5. Artificial Intelligence for Marketing: Practical Applications" Jim Sterne

Resource Material/Other Online Courses

- 1. Google AI for Business (Google AI)
- 2. AI for Everyone (Coursera Andrew Ng)
- 3. LinkedIn Learning: AI in Business Strategy