Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

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

Programme Framework

B.Sc.Data Science

Implemented from

Academic Year 2024-25

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar (Autonomous)
Board of Studies in B.Sc Data Science

Sr. No.	Name	Designation
1.	Prof. Arun D.Gangarde	Chairman
2.	Prof.Priyamvada U. Patil	Member
3.	Prof.Bharati Danave	Member
4.	Dr.Shradhha V. Ingale	Member
5.	Prof.Aparna Kulkarni	Member
6.	Prof. Amit Apte	Academic Council Nominee
7.	Prof. Dr. Sanjeev Sabnis	Academic Council Nominee
8.	Dr. Chandrashekhar Patil	Vice-Chancellor Nominee
9.	Radhika Nimse	Alumni
10.	Dr. Shridhar D. Page	Industry Expert
11.	Mr. Milind Kanetkar	Member(co-opt)
12.	Dr.Harsha Hutridurga	Member(co-opt)

1. Prologue/ Introduction of the programme:

Artificial Intelligence and Data Science Programme prepare students with the skills to perform intelligent data analysis which is a key component in numerous real-world applications. During the past ten years, data science has emerged as one of the most high-growth, dynamic, and lucrative careers in technology. This course aims at providing not only the core technologies such as artificial intelligence, data mining and data modelling but also gives intensive inputs in the areas of machine learning and big data analytics. By the end of this course, the students will gain cross-disciplinary skills across fields such as statistics, computer science, machine learning, and logic, data scientists and will have career opportunities in healthcare, business, eCommerce, social networking companies, climatology, biotechnology, genetics, and other important areas. The major focus of this programme is to equip students with statistical, mathematical reasoning, machine learning, knowledge discovery, and visualization

skills.

The Broad goals and objectives of the BSc(Data Science)are as follows :

1. To prepare students to develop strong analytical thinking skills and problem solving abilities that benefits graduate personally and professionally.

2. While learning Data Science it is necessary to be aware with the skills of Artificial Intelligence to perform intelligent data analysis, which is a key component in numerous realworld applications.

3. This course aims at providing not only the core technologies such as artificial intelligence, data mining and data modelling but also gives intensive inputs in the areas of machine learning and big data analytics and by the end of this course, the students will gain cross-disciplinary skills across fields such as statistics, computer science, machine learning, and logic, data scientists and will have career opportunities in healthcare, business, eCommerce, social networking companies, climatology, biotechnology, genetics, and other important areas.

4. The major focus of this programme is to equip students with statistical, mathematical reasoning, machine learning, knowledge discovery, and data visualization skills.

5. To achieve and demonstrate knowledge of statistical analysis techniques utilized in business decision making .

6. To explore,sort and analyze mega data from various sources in order to take advantage of Data Science applications and reach conclusions to optimize business processes for decision support.

7. To prepare necessary knowledge base for research and development in Computer Science

2. Programme Outcomes (POs)

1. Data Science graduates will be able to design, and develop intelligent business applications to solve various industrial problems.

2. Students can use the latest tools and open source technologies to recommend the required solutions.

3. Students can figure out how to evaluate the ethical, legitimate, proficient and social standards of engineering knowledge and practices.

4. These graduates can also exhibit their domain knowledge in data handling, knowledge extraction, mobile and distributed application development, intelligence web/ecommerce development, database administration, computer hardware, networking, education and training and decision support systems using AI and Data

Science tools and techniques.

5. Students will be able to analyze a given dataset and derive insights which provide value to the business and society at large

6. The syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in domains like Healthcare, Business, Finance.

7. B.Sc. (Data Science) graduates can go for higher study in programmes like M.Sc. in Data Science and Big Data and Analytics to further add a professional touch to their knowledge and become ready for the corporate world.

8. Full Time Industry Project – Internship gives hands on experience in solving a real world problem.

B.Sc. Data Science Programme Framework: Credit Distribution

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		Core		**Elective**		**VSC**	**FP / OJT/ CEP/RP**	**Selected as Minor**											
		T	P	T	P	P	P	T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	02	02					02	02	02	02	-	02		02	02	02	02	22
	II	02	02					02	02	02	02	02	-	02	--	02	02	02	22
Diploma 5.0 / 200	III	04	02	--		02	02	02	02	-	02	02		-	02	-	02	22
	IV	04	02	--		02	02	02	02	-	02		02	--	02	-	02	22
Degree 5.5 /300	V	06	04	02	02	2	2	02	-	-	-	-	-	02	-	-	-	22
	VI	06	04	02	02	2	4	02	-	-	-	-	-	-	-	-	-	22
Total		**24**	**16**	**04**	**04**	**08**	**10**	**10**	**08**	**04**	**04**	**06**	**08**	**04**	**08**	**04**	**08**	**132**
6.0/400 Honours	VII	08	06	02	02	-	RM-04											22
	VIII	08	06	02	02		OJT-04											22
6.0/400 Honours with Research	VII	06	04	02	02		RM-04 RM-04											22
	VIII	06	04	02	02		RM-08											22
Total		**40/36**	**28/24**	**08**	**08**	**08**	**18/26**	**10**	**08**	**04**	**04**	**06**	**04**	**04**	**04**	**08**	**04**	**08**	**176**

B.Sc.Data Science Programme Framework: Course Distribution

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		T		P				T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	01		01				01	01	01	01	-	01		01	01	01	01	11
	II	01		01				01	01	01	01	01	-	01	--	01	01	01	11
		Credits Related to Major						**Selected as Minor**											
		Core		Elective		VSC	FP / OJT/ CEP/RP												
		T	P	T	P	P	P	T	P	-	P	T	P		-	-	-	-	-
Diploma 5.0 / 200	III	02	01	--		01	FP-01	01	01	-	01	01		-		-	01	-	01	11
	IV	02	01	--		01	CEP-01	01	01	-	01		01		--	01	-	01	11	
Degree 5.5 /300	V	03	02	01	01	01	FP-01	01	-	-	-	-		01	-	-	-	11	
	VI	03	02	01	01	01	OJT-01	01	-	-	-	-		-	-	-	-	10	
Total		**12**	**08**	**02**	**02**	**04**	**04**			**02**	**02**	**03**	**04**		**02**	**04**	**02**	**04**	**65**
6.0/400 Honours	VII	03	03	01	01	-	RM-01												09
	VIII	03	03	01	01		OJT-01												09
6.0/400 Honours with Research	VII	02	02	01	01		RM-01 RM-01												08
	VIII	02	02	01	01		RM-01												07
Total		**18/16**	**14/12**	**04**	**04**	**04**	**06/07**	**06**	**04**	**02**	**02**	**03**	**04**		**02**	**04**	**02**	**04**	**83/80**

B.Sc. Data Science : Credit and Course Distribution in Brackets

Level / Difficulty	Sem	Subject-1			Total
		T	P		
4.5	I	02 (01)	02 (01)		04(02)
	II	02 (01)	02 (01)		04(02)

Level / Difficulty	Sem	Credits Related to Major						IKS	Total
		Core		Elective		VSC	FP / OJT/ CEP		
		T	P	T	P	P	P	T	
5.0	III	04(02)	02(01)	--		02(01)	FP-02(01)		10(05)
	IV	04(02)	02(01)	--		02(01)	CEP-02(01)		10(05)
5.5	V	06(03)	04(02)	02(01)	02(01)	02(01)	FP-02(01)	02(01)	20 (10)
	VI	06(03)	04(02)	02(01)	02(01)	02(01)	OJT-04(01)		20(09)
Total		**12**	**08**	**(02)**	**(02)**	**04**	**04**	**(01)**	**33**
6.0	VII	03	03	(01)	(01)	-	RM-04(01)		22(09)
	VIII	03	03	(01)	(01)		OJT-04(01)		22(09)
6.0	VII	(02)	(02)	(01)	(01)		RM-04(01) RP-04(01)		22(08)
	VIII	(02)	(02)	(01)	(01)		RM-08(01)		22(07)
		18/16	14/12	04	04	04	06/07	(01)	51/48

Programme Framework (Courses and Credits): B.Sc.Data Science

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-01	BS-DS 111T-A	Programming Fundamentals for Data Science	02
2.	I	I	4.5	DSC-01	BS-DS 111T-B	Applied Mathematics	02
3.	I	I	4.5	DSC-02	BS-DS 112P-A	Laboratory on Programming Fundamentals for Data Science	02
4.	I	I	4.5	DSC-02	BS-DS 112P- B	Laboratory on Applied Mathematics	02
5.	I	II	4.5	DSC-03	BS-DS 121T- A	Fundamentals of Data Science	02
6.	I	II	4.5	DSC-03	BS-DS 121T- B	Software Engineering	02
7.	I	II	4.5	DSC-03	BS-DS 121T- C	Computer Networks	
8.	I	II	4.5	DSC-04	BS-DS 122P-A	Laboratory on Fundamentals of Data Science	02
9.	I	II	4.5	DSC-04	BS-DS 122P- B	Laboratory on Software Engineering	02
10.	I	II	4.5	DSC-04	BS-DS 122P- C	Laboratory on Computer Networks	02
11.	II	III	5.0	DSC-05	BS-DS 231T	Python Programming	**02**
12.	II	III	5.0	DSC-06	BS-DS 231T	NO SQL	**02**
13.	II	III	5.0	DSC-07	BS-DS 231P	Laboratory on Python Programming	**02**
14.	II	III	5.0	VSC-01	BS-DS 234P	Laboratory on NO SQL	**02**
15.	II	III	5.0	FP-01	BS-DS 235P	Field Project	**02**
16.	II	IV	5.0	DSC-08	BS-DS 241T	Object Oriented Programming Using Python	**02**
17.	II	IV	5.0	DSC-09	BS-DS 242T	Introduction to Artificial Intelligence	**02**
18.	II	IV	5.0	DSC-10	BS-DS 243P	Laboratory on Object Oriented Programming Using Python	**02**
19.	II	IV	5.0	VSC-02	BS-DS 244P	Laboratory on Artificial Intelligence	**02**
20.	II	IV	5.0	CEP-01	BS-DS 245P	Community Engagement Project	02
21.	III	V	5.5	DSC-11	BS-DS 351T	Advance Artificial Intelligence	02
22.	III	V	5.5	DSC-12	BS-DS 352T	Machine Learning	02
23.	III	V	5.5	DSC-13	BS-DS 353T	Big Data Acquisition and Analysis	02
24.	III	V	5.5	DSC-14	BS-DS 354P	Laboratory on Advance Artificial Intelligence	02

25.	III	V	5.5	DSC-15	BS-DS 355P	Laboratory on Machine Learning	02
26.	III	V	5.5	DSE-01	BS-DS 356T	Image Processing OR Software Engineering	02
27.	III	V	5.5	DSE-02	BS-DS 357P	Laboratory on Image Processing OR Software Engineering	02
28.	III	V	5.5	VSC-03	BS-DS 358P	Laboratory on Big Data Acquisition and Analysis	02
29.	III	V	5.5	FP-02	BS-DS 359P	Field Project	02
30.	III	V	5.5	IKS-02	BS-DS 360T	IKS (Major Specific)	02
31.	III	VI	5.5	DSC-16	BS-DS 361T	Natural Language Processing	02
32.	III	VI	5.5	DSC-17	BS-DS 362T	DevOps	02
33.	III	VI	5.5	DSC-18	BS-DS 363T	Data Visualization and Data Story Telling	02
34.	III	VI	5.5	DSC-19	BS-DS 364P	Laboratory on Natural Language Processing	02
35.	III	VI	5.5	DSC-20	BS-DS 365P	Laboratory on DevOps	02
36.	III	VI	5.5	DSE-03	BS-DS 366T	Social Web Analytics OR Software Project management	02
37.	III	VI	5.5	DSE-04	BS-DS 367P	Laboratory on Social Web Analytics OR Software Project management	02
38.	III	VI	5.5	VSC-04	BS-DS 368P	Laboratory on Data Visualization and Data Story Telling	02
39.	III	VI	5.5	OJT-01	BS-DS 369P	On-Job Training	04

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B. Sc. -I (Data Science)

Title of the Course: Programming Fundamentals for Data Science								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-01	BS-DS 111T-A	02	00	02	30	15	35	50

Learning Objectives:

1. Ability to develop algorithmic solutions for use on computers
2. Ability to perform console input and output, utilize basic operators, and perform sequential
3. Processing
4. Ability to utilize the basic control structures for selection logic and repetation logic
5. Ability to develop programs in a functional form
6. Ability to process data in arrays

Course Outcomes (Cos)

Upon completion of the course, the students will be able to:

1. Write, compile and debug programs in C language.
2. Use different data types in a computer program.
3. Design programs involving decision structures, loops, arrays and functions.
4. Use pointers to understand the dynamics of memory
5. Create and perform different file operations.

 Detailed Syllabus:

UNIT I: Fundamentals of Programming   (05 hrs)

1.1 What is a Computer?
1.2 Algorithms and flowcharts in programming
1.3 What is a Program(Code)?
1.4 Programming Basics: What is programming?,What is a programming language?
1.5 Writing source code,Running your code
1.6 Compiler and interpreters,Understanding Programaing environment.

UNIT II: C programming fundamentals   (08 hrs)

2.1 Structure of a C Program, componenets of a program.
2.2 Basic building blocks: Constants, Variable and Data Types,Tokens
2.3 Managing Input and Output Operations

2.4 Operators and Expressions:

2.5 Control Structures: Decision Making and Branching(IF-Else, switch case,goto),Decision Making and Looping(for,while,do-while)

UNIT III: Introduction To Arrays And Strings **(07 hrs)**

3.1 Arrays: Declaration,Initialization,Memory representation.

3.2 2 D Arrays: Declaration,Initialization,Memory representation

3.3 Strings: Declaration,Initialization,Memory representation

3.4 2 D Strings : Declaration,Initialization,Memory representation

UNIT IV: Functions And Introduction To Pointers **(08 hrs)**

4.1 Functions: Definition, types

4.2 User defined functions: Elements of user defined functions,cateogory(with arguments , without arguments,return type),arrays , strings and functions

4.3 Library functions: Definition,Examples,String Library Functions

4.4 Pointers: Definition, types, memory allocation,dynamic memory allocation.

UNIT V: Structures And File Management **(07 hrs)**

5.1 Structures:definition, declaration,initialization, member accessing operator,array of structure variables.

5.2 Pointers and structures.

5.3 Unions: Diference between structure and union

5.4 File Management: Introduction ,Types of files

5.5 Opening and closing a file,Varios file handling operations

Suggested Readings/Material:

Text Books:

E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN:

978-93-5316-513-0.

Reference Books:

1. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford University

Press, ISBN: 978-01-9949-147-6.

2. Kernighan B.W and Dennis M. Ritchie, "The C Programming Language", 2nd Edition,

2015, Pearson Education India, ISBN: 978-93-3254-944-9.

3. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978- 93-

8728-449-4.

4. Jacqueline A Jones and Keith Harrow, "Problem Solving with C", Pearson Education.

ISBN: 978-93-325-3800-9.

5. Dr. Guruprasad Nagraj, "C Programming for Problem Solving", Himalaya Publishing

House. ISBN-978-93-5299-361-1.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B. Sc. -I (Data Science)

Title of the Course: Applied Mathematics								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-01	BS-DS 111T-B	02	00	02	30	15	35	50

Learning Objectives:

1. To introduce the concepts of mathematical logic.
2. To introduce the concepts of sets, relations, and functions to perform the operationsassociated with it.
3. To relate practical examples to the appropriate set, function, or relation model, andinterpret the associated operations and terminology in context.

Course Outcomes (Cos)

On completion of the course, students will be able to–

1. Relate and apply techniques for constructing mathematical proofs and make use ofappropriate set operations, propositional logic to solve problems.
2. Use function or relation models to interpret associated relation.
3. Apply basic counting techniques and use principles of probability.

Detailed Syllabus:

UNIT I: Set Theory And Logic   (04 hrs)

    1.1 Sets.Set Theory,Need for sets,Representation of sets
    1.2 Set Operations
    1.3 Cardinality of Set
    1.4 Types of sets-bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets,
    1.5 Countably Infinite and Uncountably Infinite Sets, Power Set.
    1.6 Propositional Logic, Logic
    1.7 Propositional Equivalences
    1.8 Application of Propositional Logic- Translating English Sentences
    1.9 Proof by Mathematical Induction and Strong Mathematical Induction

UNIT II: Relations And Functions   (06 hrs)

    2.1 Relations Properties,n-ary Relations and Applications,Representing Relations

Closures of Relations,Equivalence Relations

2.2 Partial Orderings Partitions

2.3 Hasse Diagram

2.4 Lattices Chains and Anti-Chains

2.5 Transitive Closure

2.6 Warshall's Algorithm

2.7 Functions

2.8 Surjective

2.9 Injective and Bijective Functions

2.10 Inverse Functions and Compositions of Functions

Unit III: Counting   (05 hrs)

3.1 The Basics of Counting

3.2 Rule of Sum and Product

3.3 Permutations and Combinations

3.4 Binomial Coefficients and Identities

3.5 Generalized Permutations and Combinations

3.6 The pigeonhole principle

Unit IV: Data Presentation And Aggregation   (06 hrs)

4.1 Data Types Attributes, Variable, Discrete and Continuous Variable

4.2 Data Presentation

4.3 Frequency Distribution

4.4 Histogram

4.5 Ogive

4.6 Box-Plot,Bar Plots

4.7 Mean, Median, Mode and other Measures of Central Tendency,Arithmetic Mean (AM)

Weighted Arithmetic Mean, Arithmetic Mean Computed from Grouped Data
concept of Mean, Median, Mode, Geometric Mean (GM),
harmonic mean (HM)

Quartiles, Deciles and Percentiles.

4.8 Standard Deviation and Other Measures of Dispersion,Standard Deviation

4.9 Root Measure Square,Variance,Absolute and Relative Dispersion

UNIT V: Correlation Theory And Sampling   (05 hrs)

5.1 Moments, Skewness and Kurtosis:

Moments, Computation of Moments for Group Data, Skewness,Kurtosis,Computation of

Skewness and Kurtosis

5.2 Correlation: Bivariate data,Scatter Plots,Linear Correlation,Correlation of Attributes,
Coefficient of Correlation,Linear Regression,Concept,Least-Squares Method,Regression Lines

5.3 Elementary Sampling Theory:Sampling Theory,Random Samples and Random Numbers
Sampling with and Without Replacement,Stratified sampling

UNIT VI: Probability And Hypothesis Testing   (04 hrs)

6.1 Probability: Random Experiment,Sample Space,Events Types and Operations of events
Probability Definition Axioms (The Four Elementary Theorems) of Probability (without Proof)

Conditional Probability 'Bayes' Theorem (without Proof), Examples, Mathematical Expectations

6.2 Standard Deviation:Continuous and Discrete,PDF/PMF
   Introduction and properties (without proof) for Binomial, Normal, standard Normal, Chi-square, t, F distributions

Suggested Readings/Material:

1. K. Trivedi, "Probability and Statistics with Reliability, Queuing, and ComputerScience Applications", Wiley, 2016.
2. M. Mitzenmacher and E. Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005.
3. Alan Tucker, "Applied Combinatorics", 6th Edition, Wiley 2012. Web References

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B. Sc. -I (Data Science)

Title of the Course: Laboratory on Programming Fundamentals for Data Science								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-02	BS-DS 112P-A	00	02	02	60	15	35	50

Learning Objectives:

1.Ability to develop algorithmic solutions for use on computers

2.Ability to perform console input and output, utilize basic operators, and perform sequential

 Processing

3.Ability to utilize the basic control structures for selection logic and repetation logic

4.Ability to develop programs in a functional form

5.Ability to process data in arrays

Course Outcomes (Cos): Upon completion of the course, the students will be able to:

1.Write, compile and debug programs in C language.

2.Use different data types in a computer program.

3.Design programs involving decision structures, loops, arrays and functions.

4.Use pointers to understand the dynamics of memory

5.Create and perform different file operations.

Detailed Syllabus:

Assignment 1: "Hello world" prpgram,basic input and output programs

Assignment 2: Programs using different types of operators

Assignment 3: Programs to illustrate use of IF-Else,Switch case,goto

Assignment 4: Programs to illustrate use of loops

Assignment 5. Programs to illustrate use of arrays

Assignment 6: Programs to illustrate use of Strings

Assignment 7: Programs to illustrate use of functions

Assignment 8: Programs to illustrate use of pointers and dynamic memory allocation

Assignment 9: Programs to illustrate use of structures

Assignment 10: Programs to illustrate File hamdling operations

Suggested Readings/Material:

Text Books:

E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Reference Books:

1. Pradip Dey, Manas Ghosh, "Programming in C", 2nd Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.

2. Kernighan B.W and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.

3. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978- 93-8728-449-4.

4. Jacqueline A Jones and Keith Harrow, "Problem Solving with C", Pearson Education. ISBN: 978-93-325-3800-9.

5. Dr. Guruprasad Nagraj, "C Programming for Problem Solving", Himalaya Publishing House. ISBN-978-93-5299-361-1.

6. Workbook prepared by the college.

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B. Sc. -I (Data Science)

Title of the Course: Laboratory on Applied Mathematics								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-02	BS-DS 112P-B	00	02	02	60	15	35	50

Learning Objectives:

1.To introduce the concepts of mathematical logic.

2.To introduce the concepts of sets, relations, and functions to perform the operations associated with it.

3.To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

Course Outcomes (Cos):

On completion of the course, students will be able to–

1.Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems.

2.Use function or relation models to interpret associated relation.

3.Apply basic counting techniques and use principles of probability.

Detailed Syllabus:

1.Assignment on Set Theory and Logic .

2.Assignment on Relations and Functions .

3.Assignment on Counting .

4.Assignment on Data presentation and Aggregation .

5.Assignment on Correlation Theory and Sampling .

6.Assignment on Probability and Hypothesis Testing .

Sample Assignments

1) List out the elements of the set "The letters of the word Mississippi" 2)Create a Venn diagram to illustrate each of the following:

(F ∩ E) ∪ D (D ∪ E) ∪ F

3)Write a verbal description of the set {a, i, e, o, u}

4)Consider the sets below, and indicate if each statement is true or false.

A = {1, 2, 3, 4, 5} B = {1, 3, 5} C = {4, 6} U = {numbers from 0 to 10}

1) $3 \in B$

2) $5 \in C$

3)$B \subset A$

4)$C \subset A$

5)Show that the relation R in set Z given by $R\{(a,b) : 2\ divides\ a - b\}$ is an Equivalence relation.

6)If $R1$ and $R2$ are equivalence relations in set A , show that $R1 \cap R2$ is also on equivalence relation.

7)Check whether the relation R in R (real no's) define by $R = (a,b):a \leq b3$ is reflexive, symmetric or transitive.

8)Determine whether each of the following relations are reflexive, symmetric and transitive

(i) Relation in set A = {1,2,3,.13,14} defined by $R = (x,y):3x-y = 0$.

(ii)Relation in N defined as $R = (x,y):y = x + 5;x < 4$.

(iii)Relation in set A = {1,2,3,4,5,6} defined as $R = (x,y):y$ is divisible by x.

(iv)Relation in Z defined as $R = (x,y):x-y$ is an integer.

Similar Assignments can be designed on particular topics in syllabus from the workbook

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus

B. Sc. -I (Data Science)

Title of the Course: Fundamentals of Data Science								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-03	BS-DS 121T-A	02	00	02	30	15	35	50

Learning Objectives:

1. Understand the basics in Data Science.
2. Utilise EDA techniquesgo
3. Understand Data Analytics using Excel

Course Outcomes (Cos):

After completion of the course student will :

1. Apply data visualisation in big-data analytics
2. Apply data pre-processing techniques
3. Be comfortable using commercial and open source tools such as the Excel for data analytics and visualization.

Detailed Syllabus:

UNIT I: Introduction:

1.1 What is Data Science
1.2 Applications of Data Science
1.3 Historical Background of Data Science
1.4 Basic Components of Data Science
1.5 How Data Science Work?
1.6 Main processes of Data Science
1.7 Famous data Science tools
1.8 Real life usage of Data Science Systems
1.9 Top industries players of Data Science
1.10 Find your career in Data Science
1.11 What challenges are being faced by Data Science?
1.12 More about Data Science: Data Analysis Vs. Data Analytic, Qualitative Analysis Vs. Quantitative Analysis
UNIT II: Data Science Process:
2.1 Prior Knowledge: Objective, Subject Area, Data
2.2 Data Preparation: Data Exploration, Data Quality, Missing Values, Data Types and Conversion, Transformation, Outliers, Feature Selection, Data Sampling

2.3 Modeling: Training and Testing Datasets, Learning Algorithms, Evaluation of the Model, Ensemble Modeling
2.4 Applications
2.5 Knowledge

UNIT III : Data Exploration:
3.1 Objectives Of Data Exploration
3.2 Datasets
    3.2.1 Types of Data: Numeric or Continuous, Categorical or Nominal
3.3 Descriptive Statistics:
    3.3.1 Univariate Exploration: Measure of Central Tendency, Measure of Spread
    3.3.2 Multivariate Exploration: Central Data Point, Correlation

UNIT IV: Data Visualization:

4.1 Introduction, Motivation
4.2 Univariate Visualization : Histogram, Quartile, Distribution Chart
4.3 Multivariate Visualization: Scatterplot, Scatter Multiple, Scatter Matrix, Bubble Chart, Density Chart
4.4 Visualizing High-Dimensional Data: Parallel Chart, Deviation Chart, Andrews Curves
4.5 Steps to investigate a dataset

UNIT V : Introduction to tools required for Data science:
 Tools like R, Python , SQl,Hadoop,spark etc.

Suggested Readings/Material:

REFERENCE BOOKS :
1. Data Science Concepts and Practice Second Edition Vijay Kotu Bala Deshpande
2. Data Science for Beginners Comprehensive Guide to Most Important Basics in Data Science,Alex Cambell
2.Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
3.Big Data and Business Analytics, Jay Liebowitz, CRC press (2013)
4. Introducing Data Science Big Data, Machine Learning, And More, Using Python Tools ,DAVY CIELEN ,ARNO D. B. MEYSMAN , MOHAMED ALI

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
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Syllabus

B. Sc. -I (Data Science)

Title of the Course: Software Engineering								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-03	BS-DS 121T-B	02	00	02	30	15	35	50

Learning Objectives:

1. Identify, formulate, and solve complex problems by applying principles of software engineering.
2 Communicate effectively.
3. Understand the software development steps and apply them

Course Outcomes (Cos)

After successful completion of this course, learner will be able to
1. Compare and contrast various Software Engineering models
2. Decide on appropriate process model for a developing a software project
3. Classify software applications and Identify unique features of various domains
4. Prepare System Requirement Specification (SRS) for the given problem
5. Design and analyse Data Flow diagrams

Detailed Syllabus:

Unit I: Introduction to System Engineering   (02 hrs)

1.1 Definition
1.2 Basic Components
1.3 Elements of the system
1.4 System Components
1.5 Types of System

Unit II: Introduction to Software Engineering   (03 hrs)

2.1 Definition of Software
2.2 Characteristics of Software
2.3 Software Application Domain
2.4 Definition of Software Engineering
2.5 Need for software Engineering
2.6 Mc Call's Quality factors
2.7 The Software Process
2.8 Software Engineering Practice

Unit III: Software Development Life Cycle (SDLC) and Methodologies (08 hrs)
3.1 Introduction
3.2 Activities of SDLC

3.3 A Generic Process Model
3.4 Prescriptive Process models: Waterfall Model, Incremental Process Models,
Evolutionary process Models (Prototyping and Spiral Model)

3.5 Concurrent Models, Types

Unit IV: Requirement Engineering (05 hrs)

4.1 Introduction
4.2 Requirement Engineering Tasks
4.3 Establishing Groundwork for understanding of Software Requirement
4.4 Requirement Gathering
4.5 Feasibility study
4.6 Fact Finding Techniques

Unit V: Analysis and Design Engineering (12 hrs)

5.1 Decision Tree and Decision Table
5.2 Data Flow Diagrams (DFD)
5.3 Data Dictionary
5.4 Elements of DD
5.5 Advantages of DD
5.6 Input and Output Design
5.7 Pseudocode
5.8 Case Studies on above topics

Unit VI: Agile Development (05 hrs)

6.1 Agility
6.2 Agile Process: Principles, The Politics of Agile Development, Human Factors
6.3 Extreme Programming (XP)
6.4 Adaptive Software Development (ASD)
6.5 Scrum
6.6 Dynamic System Development Model (DSDM)

Suggested Readings:

1. Software Engineering: A Practitioner's Approach- Roger S. Pressman, McGraw hill
International Editions 2010(Seventh Edition)
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthsarthy,
B.W. Khalkar.
3. Analysis and Design of Information Systems (Second Edition) - James A. Senn, McGraw
Hill
4. System Analysis and Design- Elias Awad, Galgotia Publication, Second Edition
5. Fundamentals of Software Engineering- Rajib Mall, PHI Publication, Fourth Edition

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Syllabus
B. Sc. -I (Data Science)

Title of the Course: Computer Networks								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-03	BS-DS 121T-C	02	00	02	30	15	35	50

Learning Objectives:

1. Understand the fundamental concepts and principles of computer networks.
2. Learn about different network architectures, protocols, and topologies.
3. Explore network security mechanisms and protocols.
4. Understand the computer networking with reference to cloud computing.

Course Outcomes (Cos)

1. Understand the concept of connectionless communication and its advantages.
2. Learn about datagram-based networks and packet-switching techniques.
3. Understanad the concept of Virtualization of network.

Detailed Syllabus: Example

UNIT I: Computer Networks Overview: (07 hrs)

1.1 Basic concepts of computer networks

1.2 The formation and development of Computer Networks

1.3 The composition of computer network

1.4 Classification of Computer Networks

1.5 Topology Structure of Computer Network

UNIT II: Networking layer and Encapsulation   (07 hrs)

2.1 Introduction

2.2 Physical Layer

2.3 Data Link Layer

2.4 Network layer

2.5 Transmission Layer

2.6 Application Layer

UNIT III:Ntework Virtualization   (08 hrs)

3.1 Overview of network vitualization

3.2 Traditional Network Virtualization

3.3 How does network virtualization work?

3.4 Why is network virtualization important?

3.5 Types of network virtualization

3.6 Network virtualization security

3.7 Benefits of network virtualization

3.8 Challenges of network virtualization

3.9 Examples of network virtualization

UNIT IV: Software Defined Product   (10 hrs)

4.1 Introduction to SDN

4.2 Development of SDN

4.3 SDN Architechture

4.4 SDN Key Technology

4.5 Advantages of SDN

Suggested Readings/Material:

1. CLOUD COMPUTING TECHNOLOGYHuawei Technologies Co.,
2. T. Koponen et al. Network Virtualization in Multi-tenant Datacenters. NSDI, April, 2014.
3

B. Sc. -I (Data Science)

Title of the Course: Laboratory on Fundamentals of Data Science								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-04	BS-DS 122P-A	00	02	02	60	15	35	50

Learning Objectives:

1.To understand the basic concepts of Excel
2. To Use excel for Data cleaning
3. Understanding advanced excel concepts for data analysis and visualization.

Course Outcomes (Cos)

After Completion of the course student will be able to :

1. Clean Data , remove outliers,replace missing values
2. Define effective objectives for analytics projects
3. Work with different types of data
4. Understand charts, graphs, and tools used for analytics and use them to gain valuable insights.

Detailed Syllabus:

Assignment 1 :
1.1 Pivot Tables in Microsoft Excel: Creating Pivot Tables, More Pivot Table Functionality, Format pivot tables, Inserting Slicers, Multi-Select Option in Slicers, PivotTable Enhancements, Working with Pivot Tables, Inserting Pivot Charts.
1.2 Auditing Worksheets: Tracing Precedents, Tracing Dependents, remove precedent and dependent arrows, Showing Formulas, Check for errors frequently found in formulas

Assignment 2:
2.1 Working with Multiple Worksheets and Workbooks: Use Links and External References, use 3 D References, Consolidate Data.
2.2 Data Tools: Converting Text to Columns, Linking to External Data, Controlling Calculation Options, Data Validation, Using Data Validation, Consolidating Data, Goal Seek

Assignment 3:
3.1 Working with Others: Protecting Worksheets and Workbooks, Password Protecting a Workbook, Password Protecting a Worksheet, Password Protecting Ranges in a Worksheet, Marking a Workbook as Final
3.2 Recording and Using Macros: Recording Macros, recording a Macro, Running Macros, Editing Macros, Adding Macros to the Quick Access Toolbar, Adding a Macro to the Quick Access Toolbar

Assignment 4 :
4.1 Creating Sparklines and Random Useful Items: Sparklines, Inserting and Customizing

Sparklines, Using Microsoft Translator, preparing a Workbook for Internationalization and Accessibility, Importing and Exporting Files, Importing Text Files, Copying Data from Excel to Word, Copying Charts from Excel to Word.
4.2 Use Excel in the Cloud: Save, Share, and collaborate with others using the clouds

Suggested Readings/Material:
1) Excel 2016 Bible 1st Edition, John Walkenbach, Wiley
2) Excel 2016 for Dummies, Greg Harvey
3) Excel: Quick Start Guide from Beginner to Expert, William Fischer
4) Excel 2016 from Scratch, Peter Kalmström
5) Microsoft Excel 2019 Pivot Table Data Crunching (Business Skills), and Michael Alexander
6) Excel 2016 VBA and Macros, Tracy Syrstad

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		Theory	Practical					
						CIE	ESE	Total
DSC-04	BS-DS 122P-B	00	02	02	60	15	35	50

Learning Objectives:

1. Identify, formulate, and solve complex problems by applying principles of software engineering.
2 Communicate effectively.
3. Understand the software development steps and apply them

Course Outcomes (Cos)

After successful completion of this course, student
1. Can produce the requirements and use cases the client wants for the software being produced.
2. Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture.
3. create and specify such a software design based on the requirement specification that the software can be implemented based on the design.
4. Can assess the extent and costs of a project with the help of several different assessment methods

Detailed Syllabus:

Assignment 1: Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements.
For a set of about 20 sample problems
Assignment 2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required).
Assignment 3. Develop Structured design for the DFD model developed.
Assignmnet 4. Develop Flow-Charts to understand basic problem solving technique.

(Minimum 5 case studies should be solved on the above experiments)

Suggested Readings:

1. Software Engineering: A Practitioner's Approach- Roger S. Pressman, McGraw hill International Editions 2010(Seventh Edition)
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthsarthy, B.W. Khalkar.
3. Analysis and Design of Information Systems (Second Edition) - James A. Senn, McGraw Hill
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Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical					
						CIE	ESE	Total
DSC-04	BS-DS 122P-C	00	02	02	60	15	35	50

Learning Objectives:

5. Understand the fundamental concepts and principles of computer networks.
6. Learn about different network architectures, protocols, and topologies.
7. Explore network security mechanisms and protocols.
8. Understand the computer networking with reference to cloud computing.

Course Outcomes (Cos)

4. Understand the concept of connectionless communication and its advantages.
5. Learn about datagram-based networks and packet-switching techniques.
6. Understanad the concept of Virtualization of network.

Detailed Syllabus:

Study of basic network command and Network configuration commands. Few of the assignments are listed below

1)Hostname

a. Find the name of your system?

b. What is the significance of the name?

2) ipconfig

a. Find out the MAC address of the network interface card of your system?

b. Find the host IP address of your system?

c. Find out all the network interfaces connected to your system

3. ping

a. Find the IP address of www.vit.ac.in ?

b.Indicate what percentage of packets sent resulted in a successful response. For the packets from which you received a response, write down the minimum, average, and maximum roundtrip times in

milliseconds. Note that ping reports these times to you if you tell it how many packets to send on the command line. Explain the differences in minimum round-trip time toeach of these host

c. Now send pings with 56, 512 and 1024 byte packets to the 4 hosts above. Write down theminimum, average, and maximum round trip times in milliseconds for each of the 12 pings. Whyare the minimum round-trip times to the same hosts different when using 56, 512, and 1024 byte packets

d. For the following hosts, send pings and write down the minimum, average, and maximumround trip times in milliseconds.:- google.com

4. Netstat

a. List Various Listening Ports.

b. List TCP Ports connections

c. List UDP Ports connections

c. List all the LISTENING connections

d. find the statistics for all protocols

5.ARP

a. Try ping a couple of local addresses and a website. Then re-run the arp command. Whichaddresses are listed?

Suggested Readings/Material:

1.workbook prepared by the college
2.link : https://www.scribd.com/document/515262833/Assignment-1