

PROPOSED

First Year Curriculum Structure for
B.Voc. Degree Programme in

Data Science

(Dr Babasaheb Ambedkar Technological University, Lonere)

Semester I

Sr. No.	Course Code	Name of the Course	Teaching scheme			Evaluation Scheme			Credits	Total Marks
			L	T	P	IA	MSE	ESE		
General Education										
Theory										
1	BVDSC101	IT Foundation and Programming Concepts	3	0	0	25	0	25	3	50
2	BVDSC102	Programming in C	3	0	0	25	0	25	3	50
3	BVDSC103	Discrete Mathematical Structures	3	0	0	25	0	25	3	50
4	BVDSC104	Descriptive Statistics	3	0	0	25	0	25	3	50
Total									12	200
Skill Components										
Lab/Practical										
5	BVDSL105	IT Foundation and Programming Concepts	0	0	1	25	0	25	1.5	50
6	BVDSL106	Programming in C	0	0	1	25	0	25	1.5	50
On-Job-Training (OJT)										
7	BVDSE117	Technical Writer (SSC/Q0505)	200 (150 Marks External Assessment by NSDC / SSC and 50 Marks Internal Assessment)						15	200
Total									18	300

Semester II

Sr. No.	Course Code	Name of the Course	Teaching scheme			Evaluation Scheme			Credits	Total Marks
			L	T	P	IA	MSE	ESE		
General Education										
Theory										
1	BVDSC201	Object Oriented Programming with JAVA	3	0	0	25	0	25	3	50
2	BVDSC202	Introduction to Data Science	3	0	0	25	0	25	3	50
3	BVDSC203	Applied Probability and Statistics	3	0	0	25	0	25	3	50
4	BVDSC204	Data Structures	3	0	0	25	0	25	3	50
Total									12	200
Skill Components										
Lab/Practical										
5	BVDSL205	Object Oriented Programming with JAVA	0	0	1	25	0	25	1.5	50
6	BVDSL206	Data Structures	0	0	1	25	0	25	1.5	50
On-Job-Training (OJT)										
7	BVDSE217	Junior Software Developer (SSC/Q0508)	200 (150 Marks External Assessment by NSDC / SSC and 50 Marks Internal Assessment)						15	200
Total									18	300

Semester

I

Syllabus

Subject Name: IT foundation and Programming Concepts		
Course Code :BVDSC101		Semester: I
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: -- 25 Practical 25 Term
Credit :03		
Content		Hours
Unit – I	1.0 Computer System Characteristics And Capability	06
	Basic structure, ALU, memory, CPU, I/O devices. Development of computers. Classification of computers:(Micro, mini frame, super computer, pc, server, workstations)	
Unit – II	2.0 Data Representation With in Computer	06
	BIT, BYTE, WORD, ASCII, EBCDIC, BCD Code. Introduction to Number system: Binary, Octal, Decimal and Hexadecimal. Conversation from one number system to another number system. Introduction to Basic Gates.	
Unit – III	3.0 Input Devices and Output Devices	06
	Keyboard, Direct Entry: Card readers, scanning devices (BAR CODE, OMR, MICR),Voice input devices, Light pen, Mouse, Touch Screen, Digitizer, scanner. CRT, LCD/TFT, Dot matrix printer, Inkjet printer, Drum plotter, Flatbed plotter	
Unit – IV	4.0 Memory Devices	06
	RAM, ROM, PROM, EPROM, EEPROM. - Base memory, extended memory, expanded memory, Cache memory - Storage devices Tape, FDD, HDD, CDROM, Pen Drive.	
Unit – V	5.0 Algorithm& Flowcharts	06
	Definition and properties, Principles of flowcharting, Flowcharting symbols, Converting algorithms to flowcharts	
Unit – VI	6.0 Introduction To Programming Environment	06
	History of languages, high-level, Low level, Assembly languages etc. ,Compilers, Interpreters, Assemblers, Linkers, Loaders	

TextBooks		
Name of Authors	Title of the Book	Publisher
R. Hunt And Shell Y.	Computers And Commonsense	BPB Publications
V.Rajaraman	Computer Fundamentals	PHI Learning
Reference Books		
Ashok Arora	Fundamentals of Computer Systems.	
Russell A Stultz	Fundamentals of Computer Systems	

Subject Name: Programming in C		
Course Code :BVDSC102		Semester: I
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: -- 25 Practical 25 Term
Credit :3		
Contents		Hours
Unit – I	1.0 Introduction and Basic elements of C programming	06
	Introduction to problem solving through algorithm and flowchart, Character set, Keywords and Identifiers, Constants and Variables, Data types, Operators and Expressions, Type casting	
Unit – II	2.0 Data I/O, Control Structures	06
	Basic structure of C program, Input function scanf()and Output function printf(), Conditional branching - if, switch statement, Iterative loops – while, do while and for statement, break and continue statement	
Unit –	3.0 Arrays	06
	Introduction, Declaration and Initialization, One dimensional Arrays, Two dimensional Arrays ,Character Arrays and Strings	
Unit –	4.0 Functions	06
IV	Introduction, Standard Library Functions, User Defined Functions (UDF) – Declaration, Definition, Function call, Parameter Passing - by value and by reference, Recursion, Storage Classes	
Unit – V	5.0 Structure, Union and Pointers	06
	Defining Structure, Declaration, Initialization, Array of Structures, Nested Structures, Unions , Enumerated data type, Pointers	
Unit –	6.0 File Handling	06
	Introduction, File operations, File opening modes, File I/O, Command Line Arguments	

Text Books		
Name of Author	Title of the Book	Publisher
YashavantKanetkar	Let us C	BPB Publication
E. Balagurusamy	Programming in ANSI C	Tata McGraw Hill
Reference Books		
YashavantKanetkar	Exploring C	BPB Publication
Digital Reference		
1. https://spoken-tutorial.org/		
2. http://nptel.ac.in/courses/106104128/		

Subject Name: Discrete Mathematical Structures		
Course Code :BVDSC103	Semester: I	
Weekly Teaching Hours: TH: 03 Tut: 00	Scheme of Marking TH: 25 IA: 25 Total: 50	
TH Exam Duration: 01 Hours	Scheme of Marking PR: --	
Credit :3		
Contents		Hours
Unit – I	1.0 Introduction to Sets	15
	Introduction: Sets - finite and Infinite sets, un-countable Infinite Sets; functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.	
Unit – II	2.0 Growth of Functions and Recurrences	10
	Growth of Functions: Asymptotic Notations, Summation formulas and properties, Bounding Summations, approximation by Integrals Recurrences: Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Recurrence Trees, Master Theorem	
Unit – III	3.0 Graph Theory	10
	Graph Theory : Basic Terminology, Models and Types, multigraphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees	
Unit – IV	4.0 Proportional Logic	10
	Propositional Logic : Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory	

Text Books		
Name of Author	Title of the Book	Publisher
C.L. Liu, D.P. Mahopatra	Elements of Discrete mathematics, 2nd Edition	Tata McGraw Hill, 1985
Kenneth Rosen	Discrete Mathematics and Its Applications, Sixth Edition	McGraw Hill 2006
Reference Books		
J. L. Hein	Discrete Structures, Logic, and Computability, 3rd Edition	Jones and Bartlett Publishers

Subject Name: Descriptive Statistics		
Course Code :BVDSC104		Semester: I
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: --
Credit :3		
Contents		Hours
Unit – I	1.0 Introduction to Statistics	10
	Introduction to Statistics : Introduction to Statistics – Primary and Secondary data – Nominal, Ordinal, Ratio, and Interval scale (with examples) - Graphical Representation of data – Bar-charts, Pie-diagrams, Histograms, Frequency polygon, Ogives	
Unit – II	2.0 Measures of Central Tendency and Dispersion	15
	Measures of central tendency: – properties – merits and demerits – weighted means– graphical location of median, quartiles, deciles, percentiles, and mode – relation between arithmetic mean, geometric mean and harmonic mean. Measures of dispersion : – characteristics – Coefficient of dispersion – Coefficient of variation – Moments – Relation between moments about mean in terms of moments about point – Pearson’s coefficients	
Unit – III	3.0 Skewness, Kurtosis and Curve Fitting	10
	Skewness and Kurtosis – Pearson’s coefficient of Skewness – Bowley’s coefficient of Skewness – coefficient of Skewness based upon moments. Curve fitting – Principle of least squares – Fitting of straight line, parabola, exponential and power curve.	
Unit – IV	4.0 Correlation, Regression and Hypothesis Testing	10
	Correlation and Regression: Simple correlation – Karl Pearson’s coefficient. Of correlation – Rank correlation –Simple Regression – lines of regression – properties of regression coefficient –Multiple and Partial correlation coefficient in three variables. Hypothesis Testing: Estimation and Hypothesis testing, t-test, chi-square test, ANOVA	

Text Books		
Name of Author	Title of the Book	Publisher
Agarwal.B.L	Basic Statistics, 3/e	New Age International (P) Ltd
S.P.Gupta	Statistical Methods	Sultan Chand & sons
Reference Books		
Gupta,S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics, 10/e	Sultan Chand & sons

Lab- IT Foundation and Programming Concepts

Course Code : BVSWL105	Semester: I
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration:--	Scheme of Marking PR: 25 , IA: 25 , Total: 50
Credit:1.5	

Content

List of Experiments :

1. Identify the internal and external hardware/peripheral components
2. Familiarization with operating system along with file management commands like create, copy, move, delete and rename files and folders.
3. Prepare and print Bio-data with a covering letter using word processor.
4. Calculation of Total mark, grade based on boundary conditions for n number of students using Spread sheet.
5. Experiments for burning the contents in to optical disks.
6. Preparation of presentation (with transition and animations , insertion of scanned images and internet contents)
7. Email id creation, sending and receiving of email with attachments.
8. Algorithm to calculate average of 3 numbers, area of triangle, volume of cylinder, Temperature conversion.
9. Algorithm to calculate Largest of 3 numbers, Check whether even or odd, Roots of quadratic equation, Character name of the day.
10. Algorithm to Print natural numbers, Factorial value, Multiplication table, Sum of digits, Sum of a set of numbers, calculation of grade based on boundary conditions

Lab-Programming in C	
Course Code : BVDSL106	Semester: I
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration:--	Scheme of Marking PR: 25 , IA: 25 , Total: 50
Credit:1.5	
Content	
<p>Suggested List of Experiments:</p> <ol style="list-style-type: none"> 1. Programs based on input output statements (printf() and scanf()) 2. Programs based on various operators 3. Programs based on control statement (if, switch) 4. Programs based on various loops (for, while, do-while) 5. Programs based on One Dimensional Array 6. Programs based on Two Dimensional Array 7. Programs based on Function (Library functions and User Defined Function, Recursion) 8. Programs based on Pointer 9. Programs based on Structure and Union 10. Programs based on Files and Command Line Arguments (File handling functions) <p>Note: Minimum 2 programs from above list should be carried out (Preferably on Linux platform)</p>	

Semester I - On-Job-Training (OJT)/Qualification Pack

Group GEM1 of Qualifier Packs

Subject Name: Technical Writer (SSC/Q0505)	
Course Code : BVDSE117	Semester: I
Weekly Skilling Hours: PR: 24 Tut: 00	Scheme of Marking TH: 00 , IA: 00 , Total: 00
PR Exam Duration: 06 Hours	Scheme of Marking PR: 150, IA: 50, Total: 200
Credit:15	Choose any one from specified Group GEM1 of Qualification Packs
<p>Syllabus for this qualifier Pack is available on</p> <p>http://www.sscnasscom.com/qualification-pack/SSC/Q0505/</p>	

Semester

II

Syllabus

Subject Name : OOPs with Java		
Course Code: BVDSC201		Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: --
Credit : 3		
Content		Hours
Unit – I	1.0 Basics of Java	06
	History of Java, JVM, Java Environment Setup, Programming Structure and naming conventions, Variables and Data types, Operators, Decision and Control Statements, Arrays and Strings	
Unit – II	2.0 Object Oriented Programming with Java	06
	Object Oriented Programming, Features of OOPS, Class and Object, Static variables and static methods, Overloading methods, Passing and returning object as argument, Constructors and Overloading constructors	
Unit –	3.0 Inheritance	06
	Use of inheritance, IS-A, HAS-A, USES-A relationship, Method overriding, Super keyword and Final keyword, Abstract classes and methods, Packages, Interfaces	
Unit –	4.0 Exception handling and Multithreading	06
IV	Exceptions and their types ,Handling exceptions, Use of Multithread programming, Thread class and Runnable interface, Thread priority	
Unit – V	5.0 File handling and JDBC	06
	Stream classes, Class hierarchy, Creation of text file, Reading and writing text files, JDBC Architecture, JDBC Drivers, Java Database Connectivity using JDBC	
Unit –	6.0 GUI Applications	06
	Applets and its life cycle, Graphics Class, AWT, Layout managers, Event handling classes and interfaces, SWING and Its Components	

Recommended Books:

1. Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition, 2005.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley "The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3. Joshua Bloch, "Effective Java" 2nd Edition, Publisher: Addison-Wesley, 2008.
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill, 2009.
8. Paul Deitel, Harvey Deitel, "Java: How to Course", 10th Edition, Prentice Hall, 2011.

Subject Name : Introduction to Data Science		
Course Code: BVDSC202		Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: --
Credit : 3		
Content		Hours
Unit – I	1.0 Introduction to Data Science	10
	Introduction to Data Science: Foundation of Data science, Area and Scope of Data Science, Steps of Data Science Process: Data collection, Pre- processing, training, and testing. Use cases in various domain such Image, Natural Language, Audio and Video.	
Unit – II	2.0 Introduction to Artificial Intelligence	10
	Introduction to Artificial Intelligence: Introduction Artificial Intelligence, The Foundations of AI, AI Technique, Production system characteristics, Production systems: 8-puzzle problem. Searching: Uniformed search strategies – Breadth first search, depth first search.	
Unit –	3.0 Searching Algorithms and Learning	15
	Searching Algorithms and Learning: Local Search Algorithms: Generate and Test, Hill climbing, simulated annealing search, Constraint satisfaction problems, Greedy best first search, A* search, AO* search. Self-Learning: Propositional logic - syntax & semantics , Game Playing: Overview, Minimax algorithm, Alpha-Beta pruning, Additional Refinements	
Unit – IV	4.0 Introduction to Data Mining and Machine Learning	10
	Introduction to Data Mining and Machine Learning: Introduction to Data Mining and Machine Learning, Supervised, Unsupervised and Reinforcement learning. Prediction vs Classification v/s Clustering. Association Rule Mining, classification and regression techniques, clustering, Scalability and data management issues in data mining algorithms, measures of interestingness	

Recommended Books:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontline" by Schroff /O'Reilly, 2013.
2. S. Russell and P. Norvig, Artificial Intelligence A Modern Approach, 2nd Edition. Pearson Education, 2007.
3. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.
4. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" 1st Edition by Bantam, 2007.
5. Eric Siegel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.
6. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, LinkedIn, Goole+,

Subject Name : Applied Probability and Statistics		
Course Code: BVDSC203		Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: --
Credit : 3		
Content		Hours
Unit – I	1.0 Basic Probability	10
	Basic Probability - Random Experiments - Sample Spaces Events - The Concept of Probability -The Axioms of Probability - Some Important Theorems on Probability - Assignment of Probabilities -Conditional Probability -Theorems on Conditional Probability – Independent Events -Bayes’ Theorem or Rule Combinatorial Analysis - Fundamental Principle of Counting - Tree Diagrams -Permutations	
Unit – II	2.0 Random Variables and Probability Distributions	10
	Random Variables and Probability Distributions - Random Variables - Discrete Probability Distributions –Distribution Functions for Random Variables - Distribution Functions for Discrete Random Variables - Continuous Random Variables – Graphical Interpretations Joint Distributions Independent Random Variables - Change of Variables - Probability Distributions of Functions of Random Variables – Convolutions – Conditional Distributions Applications to Geometric Probability.	
Unit – III	3.0 Mathematical Expectation	10
	Mathematical Expectation - Definition of Mathematical Expectation - Functions of Random Variables - Theorems on Expectation - Variance & Standard Deviation - Theorems on Variance - Standardized Random Variables - Special Probability Distributions - Binomial Distribution - Normal Distribution - Poisson Distribution	
Unit – IV	4.0 Sampling Theory	15
	Sampling Theory - Population and Sample - Statistical Inference- Sampling With and Without Replacement Random Samples - Random Numbers - Population Parameters - Sample Statistics -Sampling Distributions - Sample Mean - Sampling Distribution of Means - Sampling Distribution of Proportions - Sampling Distribution of Differences and Sums – Sample Variance - Sampling Distribution of Variances - Computation of Mean, Variance, and Moments for Grouped Data - The Least- Squares Parabola - Multiple Regression Standard Error of Estimate The Linear Correlation Coefficient Generalized Correlation Coefficient Rank Correlation	

Recommended Books:

1. Murray R. Spiegel, John J. Schiller & R. Alu Srinivasan, “Probability and Statistics”, Schaum outlines, McGraw Hill, 3rd edition, 2009.
2. S. P. Gupta, Statistical Methods, S. Chand and Sons.
3. S. C Gupta and V. K. Kapoor, “Fundamentals of Mathematical Statistics”, 11th edition, S.Chand and Sons.

Subject Name : Data Structures		
Course Code :BVDSC204		Semester: II
Weekly Teaching Hours: TH: 03 Tut: 00		Scheme of Marking TH: 25 IA: 25 Total: 50
TH Exam Duration: 01 Hours		Scheme of Marking PR: --
Credit:3		
Content		Hours
Unit – I	Introduction	06
	Introduction: Data Structures types, Importance of Data Structure, Abstract data Type. Algorithms: Complexity, Time space Trade-offs, Arrays: Operation Performed on array Dynamic Memory Allocation	
Unit – II	Searching Techniques	06
	Searching Techniques: List Searches using Linear Search, Binary Search, Sorting Techniques: Basic concepts, Sorting by: Bubble, Insertion and selection. Hash Function: Address calculation techniques, Common hashing Functions, Collision resolution, Linear probing, quadratic probing	
Unit –III	Unit 3	06
	Stack: LIFO structure, PUSH and POP operations, Polish Notation, Queue: FIFO structure, Circular Queue, Operations on Queues.	
Unit – IV	Unit IV	06
	Introduction, single linked list, Operations on a Single linked list, Advantages and disadvantages of single linked list, circular linked list, Double linked list	
Unit – V	Unit V	06
	Tree: General tree terminology, Tree traversal, Operation on Binary Tree Heap : Heap Sort	
Unit – VI	Unit 6	06
	Graphs: Graph Storage structure (Adjacency Matrix, Adjacency List)Operations on graphs Traverse Graph (Depth-First, Breadth-First), Minimum Spanning Tree, Kruskal's algorithm, Prim's algorithm,	

Text Books		
Name of Authors	Title of the Book	Publisher
Ellis Horowitz Sartaj Sahani, Susan Anderson Freed	Fundamentals of Data Structures in C 12 nd Edition]	Universities Press.
Lipschut	Data structure	MGH
Reference Books		
A. Tanenbaum	Data and file structure	PHI

Lab – OOP with Java

Course Code : BVDSL205	Semester: II
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration:--	Scheme of Marking PR: 25 , IA: 25 , Total: 50
Credit:1.5	

Contents

- Design a simple Java class with appropriate programming structure and naming conventions
- Sample programs on conditional statements and loop controls
- Demonstrate class, object and methods with various access modifiers
- Sample program on static variables and static methods
- Sample program on passing and returning object as argument
- Demonstrate constructors overloading
- Demonstrate types of inheritance
- Abstract classes and methods
- Program on Packages and Interfaces
- Demonstration of threads using Thread class and Runnable Interface
- Sample programs on file handling operations
- CRUD operations using JDBC

LAB - Data Structures	
Course Code : BVDSL206	Semester: II
Weekly Practicals: PR: 01 Tut: 00	Scheme of Marking TH: --
TH Exam Duration:--	Scheme of Marking PR: 25 , IA: 25 , Total: 50
Credit:1.5	
Contents	
Suggested List of Experiments:	
<ol style="list-style-type: none"> 1. Write a program to demonstrate insertion, deletion, search and displaying of an element in an array, 2. Write a program to demonstrate sorting algorithm. (using any one of these techniques: bubble, Insertion, selection) 3. Write a program to demonstrate operations performed on stack. 4. Program to convert infix expression to postfix and infix to postfix. 5. Write a program to demonstrate operations on queue. 6. Write a program to demonstrate operations on singly link list. 7. Write a program to implement Stack as Linked List. 8. Write a program to implement operations on double link list. 9. Write a program to demonstrate creation, traversing and searching in Binary Search Tree. 10. Write a program to traverse a graph using DFS with an adjacency matrix. 11. Write a program to traverse a graph using BFS with an adjacency matrix. 	
References:	
<ol style="list-style-type: none"> 1. Unix Concepts and Applications by Sumitabha Das 2. http://www.ossec.net/ 3. www.linuxmanpages.com/man1/pflogsumm.1.php 4. www.webalizer.org/ 5. http://www.computersecuritystudent.com/SECURITY_TOOLS/DVWA/ 6. https://www.wireshark.org/#learnWS 7. https://wiki.openssl.org 	

Subject Name: Junior Software Developer (SSC/Q0508)	
Course Code : BVDSE217	Semester: II
Weekly Skilling Hours: PR: 24 Tut: 00	Scheme of Marking TH: 00 , IA: 00 , Total: 00
PR Exam Duration: 06 Hours	Scheme of Marking PR: 200 , IA: 00 , Total: 200
Credit:15	Choose any one from specified Group GEM1 of Qualification Packs
Syllabus for this qualifier Pack is available on	
https://www.sscnasscom.com/qualification-pack/SSC/Q0508/	