SAMARTH EDUCATIONAL TRUST
SAWKAR INSTITUTES
SATARA

AGCE

SYLLABUS FIRST YEAR

Bachelor of Vocation

Syllabus and Course Structure of First Year B.Voc (Data Science) Programme at Arvind Gavali College of Engineering, Satara - Designed to nurture foundational knowledge, practical skills, and holistic development for future engineers

ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA.

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SAMARTH EDUCATIONAL TRUST
ARVIND GAVALI COLLEGE OF ENGINEERING
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• BCA 6545, MCA 6545, B.Voc 6545

First Year B.Voc Data Science 2025-26

SEMESTER – I

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./ Week	Cr	Components	Max	Min for Passing	
1	PCC	25BVD1101	Basics of Computing	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
2	BSC/ESC	25BVD1102	Statistics for Data Science - I	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
3	PCC	25BVD1103	Programming in C	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
4	BSC/ESC	25BVD1104	Mathematics for Data Science	3	--	--	3	3	CA1	10		40
									MSE	20		
									CA2	10		
									ESE	50	20	
5	IKS	25BVD1105	Constitution of India	2	--	--	2	2	CA1	25		20
									MSE	--		
									CA2	25		
									ESE	--	--	
6	AEC	25BVD1106	Communication Skills	2	--	--	2	2	CA1	25		20
									MSE	--		
									CA2	25		
									ESE	--	--	
7	PCC	25BVD1101L	Basics of Computing Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
8	BSC/ESC	25BVD1102L	Statistics for Data Science - I Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
9	PCC	25BVD1103L	Programming in C Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
10	AEC	25BVD11105L	Communication Skills Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
11	OJT	25BVD1107	SSC/Q0508 Junior Software Developer	--	--	--	--	12	CA1	50		80
									CA2	50		
									OE	100	40	
			Total	**16**	**--**	**08**	**24**	**32**		**1100**		
Total Contact Hours – 24 Total Credits - 32												

First Year B.Voc Data Science 2025-26
SEMESTER – II

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./Week	Cr	Components	Max	Min for Passing	
1	PCC	25BVD1201	Introduction to Data Science	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
2	PCC	25BVD1202	Data Structures	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
3	PCC	25BVD1203	Object Oriented Programming Using C++	3	--	--	3	3	CA1	10		40
									MSE	30		
									CA2	10		
									ESE	50	20	
4	BSC/ESC	25BVD1204	Statistics for Data Science - II	3	--	--	3	3	CA1	10		40
									MSE	20		
									CA2	10		
									ESE	50	20	
5	AEC	25BVD1205	Development of Life Skills	2	--	--	2	2	CA1	25		20
									MSE	--		
									CA2	25		
									ESE	--	--	
6	PCC	25BVD1202L	Data Structures Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
7	PCC	25BVD1203L	Object Oriented Programming Using C ++ Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
8	BSC/ESC	25BVD1204L	Statistics for Data Science – II Laboratory	--	--	2	2	1	CA1	25		40
									CA2	25		
									POE	50	20	
10	AEC	25BVD1205L	Development of Life Skills Laboratory	--	--	2	2	1	CA1	25		20
									CA2	25		
									POE	--	--	
11	OJT	25BVD1206	NIE/ITS/Q15008 Data Analysis Assistant	--	--	--	--	12	CA1	50		80
									CA2	50		
									OE	100	40	
			Total	**14**	**--**	**08**	**22**	**30**		**1000**		
Total Contact Hours – 22 Total Credits - 30												

Title of the Course: Introduction to Data Science Course Code: 25BVD1201	L	T	P	Credit
	3	--	--	3

Course Prerequisite:

1. Basic Computer Skills: Familiarity with computers and basic software applications.
2. Mathematics: Understanding of basic mathematical concepts, including algebra and statistics.
3. Basic Programming: Familiarity with programming concepts and languages (not mandatory but beneficial).

Course Description:

Introduction to Data Science is a foundational subject that provides students with a comprehensive overview of the field of data science, including its concepts, tools, and applications. This subject covers the data science lifecycle, including data acquisition, cleaning, analysis, visualization, and interpretation

The subject aims to equip students with a solid understanding of data science principles and practices, preparing them for further study or careers in data analysis, science, and related fields.

Course Objectives:

By the end of this course, the students will be able to:

1. A solid understanding of data science concepts and principles.
2. Practical skills in data analysis, visualization, and interpretation.
3. Familiarity with popular data science tools and technologies.
4. The ability to extract insights and make data-driven decisions.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Clearly define data science and its applications, and explain the role of data science in various industries.
CO2	Collect data from various sources, clean and preprocess data to ensure quality and accuracy, and prepare data for analysis.
CO3	Apply descriptive and inferential statistical techniques to analyze data, identify patterns, and extract insights.
CO4	Effectively visualize data using various tools and techniques, and communicate insights and findings to both technical and non-technical audiences.
CO5	Utilize popular data science tools and technologies, data visualization software, to work with data and solve real-world problems.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	2	2			2			2		
CO2	2	3		3	3		2				
CO3	3	3		3	2						
CO4			2		3	2	2		3		
CO5		3		3	3		2	2			2

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	10
MSE	30
CA2	10
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**Introduction** Data Science: Introduction and History, Data Science Process: Discovery, Preparation, Model Planning, Model Building, Operationalize and Communicate Results, Data Science tools, Uses of Data Science, Challenges of Data Science, Applications of Data Science, Data Science vs Business Intelligence, Data Analyst, Data Engineer and Data Scientist.	**08**
2	**Data** Concept of Data, Information, Knowledge and Wisdom, Effect of data influence on human lives, Types of Data: Primary Data and Secondary Data, Quantitative (Discrete data and Continuous data [Interval data and Ratio data])and Qualitative Data (Nominal data and Ordinal data), Structured, Unstructured Data and Semi-structured, Methods of Primary Data Collection, Methods of Secondary Data Collection	**08**

3	**Data Sampling** Concept of Population, Census, Sample, Sampling, Sampling Frame and Sample Size, Importance of Sampling, Types of Sampling – Probability Sampling - Simple Random, Systematic, Stratified and Cluster, non-probability Sampling - Convenience sampling, Purposive sampling, Snowball sampling and Quota sampling	**08**
4	**Data Analytics** Concept of Data Analytics, Importance of Data Analytics, Data Analytics, Types Descriptive Analytics, Predictive Analytics, Prescriptive Analytics and Diagnostic Analytics	**08**
5	**Data Quality and Ethics** Data Governance: Introduction, Benefits and Challenges, Data Quality: Introduction and Importance, Data Quality Dimensions - Accuracy, Completeness, Consistency, Timeliness, Uniqueness and Validity, Concept of Data accuracy and Data Precision, Benefits of Quality Data, Data quality best practices, Ethics in Data Science, Need for ethical guidelines, Data Science Ethics Examples	**08**

Text Books

Sr. No.	Title	Author	Publisher
1	Getting Started with Data Science	Murtaza Haider	Pearson Education
2	Fundamentals of Data Science	Samuel Burns	Samuel Burns
3	Data Science Concepts and Practice	Vijay Kotu, Bala Deshpande	Elsevier Science

Useful Links:
https://mdsr-book.github.io/mdsr2e/index.html
https://data-flair.training/blogs/data-science-tutorials-home/
https://www.guru99.com/data-science-tutorial.html
https://www.edureka.co/blog/what-is-data-science/

Title of the Course: Data Structures Course Code: 25BVD1202	L	T	P	Credit
	3	--	--	3

Course Prerequisite:

1. Basic Programming Skills: Familiarity with programming concepts and languages.
2. Problem-Solving Skills: Ability to analyze problems and develop algorithmic solutions.
3. Basic Data Types and Operators: Understanding of basic data types, operators, and control structures in programming.
4. Introduction to Algorithms: Familiarity with basic algorithmic concepts, such as sorting and searching.

Course Description:

Data Structures is a fundamental subject in the B.Voc program that introduces students to the organization, management, and manipulation of data in a computer system. This course covers various data structures such as arrays, linked lists, stacks, queues, trees, and graphs, and explores their applications in real-world problems.

Course Objectives:

By the end of this course, the students will be able to:

1. Foundational Knowledge of Data Structures: A thorough understanding of various data structures, including arrays, linked lists, stacks, queues, trees, and graphs.
2. Ability to Analyze and Design Data Structures: The ability to analyze problems and design suitable data structures to solve them efficiently.
3. Skills to Implement and Manipulate Data Structures: The skills to implement and manipulate data structures using programming languages, ensuring efficient data management and retrieval.
4. Problem-Solving Skills using Data Structures: The ability to apply data structures to solve real-world problems

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Implement various data structures, such as arrays, linked lists, stacks, queues, trees, and graphs, to solve real-world problems.
CO2	use various search and sort techniques.
CO3	solve simple problems related with stack and queue.
CO4	demonstrate various types of linked lists.
CO5	Perform various Preorder, In order and Post order operations.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	3	3	3	2						
CO2	3	3	2	3	2						
CO3	2	2	2	3	2						
CO4	3	2	2	2							
CO5	2	2	2	3							

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	10
MSE	30
CA2	10
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**Introduction to Data Structure** Concept of Data and Database, Data Structure: Introduction, Importance, Classification, Operations - Traversal, Search, Insertion, Deletion, Sorting & Merging and Applications, Difference between Data structure and Database, Abstract Data Type, Concept of Algorithm, Algorithm Complexity	**08**
2	**Searching and Sorting** Concept of Searching, Types of Searching - Linear and Binary Search, Concept of Sorting, Types of sorting - bubble sort, selection sort, insertion sort, radix sort, quick sort, merge sort and heap sort	**08**
3	**Stack and Queue** Concept of Stack, Algorithms for Stack operations - PUSH, POP, PEEK and PEEP, Multiple Stack, Applications of Stack , Concept of Queue, Algorithms for Queue operations - Enqueue and Dequeue,	**08**

	Applications of Queue, Circular Queue, Double Ended Queue (Dequeue) and Priority Queue	
4	**Linked Lists** Concept of Singly Linked Lists and Operations on Singly Linked Lists - Creating list, traversing list, inserting element, deleting element and Searching element, Concept of Doubly Linked Lists and Operations on Doubly Linked Lists - Creating list, Traversing list, inserting element, deleting element and Searching element, Concept of Circular Linked Lists and Operations on Circular Linked Lists - Creating list, Traversing list, Inserting element, Deleting element and Searching element	**08**
5	**Tree** Concept of Tree, Tree Terminology - Root, Edge, Parent, Child, Path, Sub tree, Leaf Nodes, Degree of node, Degree of Tree, Height of Tree and Depth of tree, Concept of Binary Tree, Representation of Binary Tree, Binary Tree Traversal - Preorder, In order and Post order	**08**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	A Textbook of Data Structures and Algorithms	G. A. Vijayalakshmi Pai	Wiley
2	Algorithms and data structures using Java	William McAllister	Jones & Bartlett Learning
3	Data Structures and Algorithms Made Easy	Narasimha Karumanchi	Career Monk Publications

Useful Links:
https://www.studytonight.com/data-structures/
https://www.programiz.com/dsa
https://www.geeksforgeeks.org/data-structures/
https://www.javatpoint.com/data-structure-tutorial

Title of the Course: Object Oriented Programming Using C++ Course Code: 25BVD1203	L	T	P	Credit
	3	--	--	3

Course Prerequisite:

The prerequisites for learning C++ programming is:

1. Logical Thinking and
2. Problem-Solving Skills

Course Description:

C++ Programming is a fundamental subject in the B.Voc program that introduces students to the principles and practices of object-oriented programming using C++. This course covers the basics of C++ syntax, data types, control structures, functions, arrays, pointers, and object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and encapsulation. Students learn to design, develop, and test C++ programs, applying problem-solving skills and best practices in software development.

Course Objectives:

By the end of this course, the students will be able to:

1. Basic Computer Knowledge: Familiarity with basic computer concepts, including hardware, software, and operating systems.
2. Introduction to Programming: Basic understanding of programming concepts, including variables, data types, control structures, and functions.
3. Problem-Solving Skills: Ability to analyze problems and develop logical solutions, including understanding of algorithms and flowcharts.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Apply object-oriented programming principles, including classes, objects, inheritance, polymorphism, and encapsulation, to develop efficient and reusable code.
CO2	use C++ data types, operators, and control structures to manipulate data and control program flow.
CO3	use various control loops to manipulate data and control program flow.
CO4	write small C++ programs on arrays and functions.
CO5	Know file handling using C++

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	2		2							
CO2	2	2	2	3	3						
CO3	3	2	2	2	3						
CO4	3	3		3							
CO5	2	3	3	3	2						

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	10
MSE	30
CA2	10
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**Introduction to C++** C++: history, uses, applications and structure of C++ program, Header files, Keywords, variable, variable scope - local and global; constants - character, integer, float, string; escape sequences, data types - built-in and user defined	**08**
2	**Operators and I/O in C++** Operators - arithmetic, relational, logical, assignment, bitwise and conditional; operator precedence and associativity, Simple programs using Cout and Cin, Manipulator: definition, endl, setw and setfill	**08**
3	**Control Structures and Looping** Decision making constructs - If, If-Else, Nested If-Else and Switch, Looping constructs - While, For, do-while and nested looping, Infinite loop, loop control statements - break, continue, go to and Exit	**08**

4	**Array and function** Array - definition, advantages, array declaration, initialization and accessing element of array, Two-dimensional array - declaration, initialization, accessing element of two- dimensional array, character array and pointer, Function, advantages of function, defining function - return type, function name and parameters; declaring function, function arguments - pass by value and pass by reference and function recursion	**08**
5	**Exception Handling and File** Exception, handling exception in C++: Throw, Try, Catch, File: introduction, file stream classes, opening & closing file, writing to file, reading from file and file position pointers	**08**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	Let us C++	Yashavant Kanetkar	BPB Publication
2	Programming with C++	John R. Hubbard	Tata McGraw Hill
3	Mastering C++	K.R. Venugopal	Tata McGraw Hill

Useful Links:
https://www.javatpoint.com/cpp-tutorial
https://www.programiz.com/cpp-programming
http://nptel.ac.in/courses/106/105/106105225

Title of the Course: Statistics for Data Science - II Course Code: 25BVD1204	L	T	P	Credit
	3	--	--	3

Course Prerequisite:

Basic probability, algebra, set theory, calculus (limits and integration), and descriptive statistics (mean, variance, standard deviation), along with familiarity in data interpretation, graphical representation, and logical reasoning.

Course Description:

The Statistics for Data Science course provides a comprehensive foundation in statistical concepts and techniques essential for data science. Students will learn basic probability, algebra, and set theory, as well as calculus concepts such as limits and integration. The course also covers descriptive statistics, including measures of central tendency and variability like mean, variance, and standard deviation.

Course Objectives:

By the end of this course, the students will be able to:

1. To introduce students to the concepts of random variables and probability distributions, enabling them to model, analyze, and visualize uncertainty in real-world data scenarios.
2. To develop the ability to apply and interpret binomial, Poisson, and normal distributions in practical contexts through their mathematical properties and graphical representations.
3. To enable students to understand and apply principles of sampling, estimation, and sampling distributions for effective statistical inference from population data.
4. To teach students methods for analyzing relationships between variables using correlation and regression techniques, including multiple and partial correlation.
5. To equip students with the skills to perform hypothesis testing using various statistical tests and interpret confidence intervals, errors, significance levels, and ANOVA results in decision-making.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	distinguish between discrete and continuous random variables, and interpret their probability distribution functions using graphical and analytical approaches.
CO2	apply binomial, Poisson, and normal distributions to real-life problems by calculating and interpreting their parameters, graphical behavior, and relevance.
CO3	demonstrate the ability to perform statistical inference using appropriate sampling methods and distributions, including estimation of mean, variance, and proportions.
CO4	Students will analyze relationships between variables using correlation and regression, and apply hypothesis testing methods to support data-driven decision-making.
CO5	Describe testing of Hypothesis

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	3		2	2						
CO2	3	3		3	2						
CO3	3	3		3	2						
CO4	3	3		3	2	2					
CO5	2	3		3	2	2					

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	10
MSE	30
CA2	10
ESE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**Random Variables and Probability Distributions** Random Variables: Definition and types (Discrete and Continuous), Discrete Probability Distributions, Introduction of Probability distributions and non-probability distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables, Graphical Interpretations: Visualizing Probability Mass Functions (PMFs) and Probability Density Functions (PDFs), Joint Distributions, Independent Random Variables, Change of Variables, Probability Distributions of Functions of Random Variables, Convolutions, Combining independent random variables, Conditional Distributions, Applications to Geometric Probability	**08**
2	**Probability Distributions** Binomial Distribution: Real-life applications (e.g., coin tosses, quality testing), Assumptions and conditions, Probability Mass Function	**08**

	(PMF), Mean and variance, Graphical representation Poisson Distribution: Real-life applications (e.g., customer arrivals, call centers), Assumptions and conditions, PMF, Mean and variance, Graphical representation, Normal Distribution: Real-life applications (e.g., height, marks distribution), Features of normal distribution, Probability Density Function (PDF), Parameters: mean (μ), standard deviation (σ), Bell curve and symmetry, Standard normal distribution	
3	**Sampling Theory** 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	**08**
4	**Correlation and Regression** Correlation and Regression: Simple correlation – Karl Pearson's coefficient of correlation – Rank correlation – Simple Regression – lines of regression – properties of regression coefficient Multiple Regression - Standard Error of Estimate - The Linear Correlation Coefficient - Generalized Correlation Coefficient - Rank Correlation. Multiple and Partial correlation coefficient in three variables.	**08**
5	**Testing of hypothesis** Hypothesis: Introduction, Types of Hypotheses - Null Hypothesis and Alternate Hypothesis, Types of Hypothesis Testing - Z Test, T Test and Chi Square Test, Hypothesis Testing and Confidence Intervals, Type 1 and Type 2 Error, Level of Significance, P-Value, ANOVA	**08**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	Basic Statistics	B. L. Agarwal	New Age International
2	Statistical Methods	S. P. Gupta	Sultan Chand & sons
3	Fundamentals of Mathematical Statistics	S. C. Gupta and V. K. Kapoor	Sultan Chand & sons
4	Statistics (Theory & Practice)	R S N Pillai	S. Chand Limited
5	Statistics for Business and Marketing Research	Kishore K. Das, Deepjyoti Bhattacharjee	PHI Learning

Useful Links:
https://www.youtube.com/watch?v=xxpc-HPKN28
https://www.statology.org/tutorials/
https://www.tutorialspoint.com/statistics/index.htm

Title of the Course: Development of Life Skills Course Code: 25BVD1205	L	T	P	Credit
	2	--	--	2

Course Prerequisite:

1. Basic Communication Skills: Ability to communicate effectively in spoken and written forms.
2. Self-Awareness: Understanding of one's own strengths, weaknesses, values, and goals.
3. Positive Attitude: Willingness to learn, grow, and develop a positive mindset.

Course Description:

Development of Life Skills is a subject designed for B.Voc students to equip them with essential life skills that enhance their personal and professional growth. This course focuses on developing skills such as communication, teamwork, time management, problem-solving, leadership, and adaptability, enabling students to navigate the challenges of the modern workplace and beyond. Through interactive sessions, case studies, and practical exercises, students learn to build confidence, resilience, and a positive attitude, preparing them to excel in their chosen careers and make a meaningful impact in their communities.

Course Objectives:

By the end of this course, the students will be able to:

1. Effective Communication Skills: The ability to communicate effectively in personal and professional settings, including verbal, non-verbal, and written communication.
2. Self-Awareness and Emotional Intelligence: A deeper understanding of themselves and others, including emotional intelligence, self-awareness, and empathy.
3. Problem-Solving and Decision-Making Skills: The skills to analyze problems, identify solutions, and make informed decisions in personal and professional contexts.
4. Personal and Professional Growth Strategies: Strategies to manage stress, build resilience, and cultivate a growth mindset, enabling them to achieve their personal and professional goals.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Understand their strengths, weaknesses, values, and goals, and develop a growth mindset.
CO2	Collaborate effectively with others, including teamwork, leadership, and conflict resolution.
CO3	Analyze problems, identify solutions, and make informed decisions using critical thinking and problem-solving skills.
CO4	Prepare career plan considering their knowledge and skillset.
CO5	Importance of emotional intelligence in enhancing personal and organizational effectiveness.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	1						2		1	2	
CO2	2	2	3				2	1			
CO3			3				1			2	
CO4	2						1		3	3	
CO5	1						2		1	2	

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2) will have 50% weightage, respectively.

Assessment Component	Marks
CA1	25
MSE	--
CA2	25
ESE	--

CA1 and CA2 are based on Assignment/Declared test/Quiz/Seminar/Group discussions/presentation, etc.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**Personal Development** Importance of self-discipline, Need of Self Analysis, Attitude and types (positive, negative, optimistic and pessimistic) Guidelines for developing positive attitude, Time Management - Importance, prioritization of work, time matrix, time savers, and time wasters, Stress Management - types of stress, causes of stress, managing stress, and stress busters	**06**
2	**Interpersonal and Leadership Skills** Interpersonal Relation Importance, Interpersonal conflicts, Resolution of conflicts, developing effective interpersonal skills, telecommunication and conversational skills, Human Relation Skills (People Skills), Role of leadership in workshops, Basics of motivating teams, Decision-making skills, delegating tasks, Building team trust, Industry leadership practices, Handling workplace challenges.	**06**

3	**Problem-Solving Skills** Identifying issues/problems, Identify, understand and clarify the problem, Root cause analysis, Critical thinking basics, Information search, Evaluate the evidences, Consider the feasible option, Choose the best alternative, Handling challenges, Decision-making models, Industry problem-solving approaches, Documenting solutions.	**06**
4	**Career Development** Importance of continuous learning, Resume building, Industry certifications, Job interview preparation, Networking in industrial sectors, Career path options, Characteristics of Goal setting (SMART-Specific, Measurable, Attainable, Realistic, Time bound), Goal setting techniques, Building workplace confidence, Work ethics, Industry professionalism expectations. Lokpal, Lok Ayukta, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet	**06**
5	**Emotional Intelligence** Role of emotional intelligence, managing workplace emotions, Building empathy, Handling stress in teams, Improving interpersonal skills, Industry applications, Benefits for professional growth.	**06**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	The 7 Habits of Highly Effective People	Stephen R. Covey	Free Press
2	Emotional Intelligence	Daniel Goleman	Bantam Books
3	Business Communication Strategies	M.M. Monippally	McGraw Hill Education

Useful Links:
https://www.franklincovey.com/the-7-habits/
https://www.danielgoleman.info/topics/emotional-intelligence/
https://open.lib.umn.edu/businesscommunication/

Title of the Course: Data Structures Lab Course Code: 25BVD1202L	L	T	P	Credit
	-	-	2	1

Course Prerequisite:

1. Programming Fundamentals: Basic knowledge of programming concepts, including variables, data types, control structures, functions, and object-oriented programming principles.
2. Data Structures Concepts: Understanding of basic data structures, including arrays, linked lists, stacks, and queues, and their applications.
3. Programming Language Proficiency: Proficiency in a programming language, such as C, C++, to implement and test data structures.

Course Description:

Data Structures Lab is a hands-on course designed for B.Voc students to implement and apply data structures concepts using programming languages. Through a series of experiments and projects, students will design, develop, and test various data structures, including arrays, linked lists, stacks, queues, trees, and graphs. The course emphasizes practical implementation, debugging, and analysis of data structures, enabling students to develop problem-solving skills, critical thinking, and programming expertise. By working on real-world problems and projects, students will gain a deeper understanding of data structures and algorithms, preparing them for careers in software development and related fields.

Course Objectives:

By the end of this course, the students will be able to:

1. Practical Implementation Skills: Hands-on experience in implementing various data structures, including arrays, linked lists, stacks, queues, trees, and graphs, using a programming language.
2. Problem-Solving Abilities: Ability to analyze problems, design, and implement data structures to solve real-world problems, and evaluate their efficiency.
3. Algorithm Development Skills: Skills to develop and test algorithms for manipulating and processing data structures, ensuring optimal performance and scalability.
4. Debugging and Testing Skills: Ability to debug and test data structure, identifying and fixing errors, and ensuring program correctness.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	perform insertion and deletion of elements in arrays, and implement Linear Search and Binary Search algorithms.
CO2	Implement Bubble Sort and Quick Sort algorithms to perform stack operations (push, pop, peek) using arrays.
CO3	perform queue operations (enqueue, queue) and circular queue operations using arrays.
CO4	Implement operations (insertion, deletion, traversal) on Singly Linked Lists and Doubly Linked Lists
CO5	perform pre-order, in-order, and post-order traversal of trees, and implement Breadth-First Search (BFS) and Depth-First Search (DFS) graph traversal algorithms.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	3	2	3	2						
CO2	3	3	2	3	2						
CO3	2	2	2	3	2						
CO4	3	2	3	3	2						
CO5	3	3	3	3	2						

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	25
MSE	--
CA2	25
OE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Practical No.	List of Experiments	Hours
1	Write a program to insertion and deletion of element in an array.	**02**
2	Write a program for Linear and Binary Search.	**02**
3	Write a program to implement Bubble sort and Quick Sort.	**02**
4	Write a program to implement Stack operations using an array.	**02**
5	Write a program to implement Queue operations using an array.	**02**
6	Write a program to implement Circular Queue operations using an array.	**02**

7	Write a program to implement operations on Singly Linked List.	**02**
8	Write a program to implement operations on Doubly Linked List.	**02**
9	Write a program for tree pre-order, in-order and post-order traversal.	**02**
10	Write a program to implement BFS and DFS graph traversal.	**02**

Useful Links:
https://www.mygreatlearning.com/blog/data-structures-using-java/
https://www.scaler.com/topics/data-structures-in-java/
https://java2blog.com/data-structures-java/
https://www.sanfoundry.com/java-programming-examples-data-structures/

Title of the Course: Object Oriented Programming Using C++ Lab Course Code: 25BVD1203L	L	T	P	Credit
	--	--	2	1

Course Prerequisite:

1. Basic Computer Knowledge: Familiarity with basic computer concepts, including hardware, software, and operating systems.
2. Programming Fundamentals: Understanding of basic programming concepts, including variables, data types, control structures, functions, and object-oriented programming principles.
3. Introduction to Programming: Prior exposure to a programming language, such as Python or Java, or completion of an introductory programming course.

Course Description:

The Programming in C++ Lab course is a hands-on, practical component of the B.Voc program, focusing on developing programming skills in C++. This lab-based course enables students to apply theoretical concepts of object-oriented programming to real-world problems, using C++ as the programming language. Through a series of experiments and projects, students will design, develop, and test C++ programs, gaining expertise in programming principles, and algorithms. By the end of the course, students will be proficient in writing efficient, well-structured C++ code and debugging programs.

Course Objectives:

By the end of this course, the students will be able to:

1. Hands-on Experience in C++ Programming: Practical experience in writing, debugging, and testing C++ programs, enabling them to apply theoretical concepts to real-world problems.
2. Object-Oriented Programming Skills: Understanding and application of object-oriented programming principles, including classes, objects, inheritance, polymorphism, and encapsulation.
3. Problem-Solving Abilities: Ability to analyze problems, design, and implement C++ programs to solve complex problems, and evaluate their efficiency.
4. Programming Best Practices: Knowledge of programming best practices, including coding standards, debugging techniques, and testing methodologies, to ensure efficient and reliable software development.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Write Efficient C++ Code: Write efficient, well-structured, and readable C++ code to solve simple problems.
CO2	Use C++ Data Types and Operators: Use C++ data types, operators, and control statements to manipulate data and control program flow.
CO3	Work with Arrays: Use arrays to store and manipulate collections of data.
CO4	effectively use pointers in C++ programs to dynamically allocate memory, manipulate data
CO5	Implement Structure and File Operations: Implement file input/output operations to read and write data to files.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	2		3	3	2		2				
CO2	2		3	2	2		2				
CO3	3		2	3	3		3				
CO4	3		2	3	2		3				
CO5	2		3	3	3		2				

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	25
MSE	--
CA2	25
OE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.
MSE is based on 50% of course content.
ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

Course Contents

Practical No.	List of Experiments	Hours
1	Programs based on input output statements	**02**
2	Programs based on various operators	**02**
3	Programs based on control statement (if, switch)	**02**
4	Programs based on various loops (for, while, do-while)	**02**
5	Programs based on One Dimensional Array	**02**
6	Programs based on Two-Dimensional Array	**02**
7	Programs based on Function (Library functions and User Defined Function, Recursion)	**02**

8	Programs based on Pointer	**02**
9	Programs based on Structure and Union	**02**
10	Programs based on Files and Command Line Arguments (File handling functions)	**02**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	Let us C++	Yashavant Kanetkar	BPB Publication
2	Programming with C++	John R. Hubbard	Tata McGraw Hill
3	Mastering C++	K.R. Venugopal	Tata McGraw Hill
4	Object-Oriented Programming with C++	M. P. Bhave	Pearson Education India

Useful Links:
https://www.javatpoint.com/cpp-tutorial
https://www.programiz.com/cpp-programming
http://nptel.ac.in/courses/106/105/106105225

Title of the Course:Statistics for Data Science – II Lab Course Code: 25BVD1204L	L	T	P	Credit
	--	--	2	1

Course Prerequisite:

Basic Statistics Concepts, Types of Data Understanding, MS Excel Fundamentals, Graphing and Charts in Excel

Course Description:

Use MS Excel to organize data, perform basic statistical analysis, calculate probabilities, create charts, and test hypotheses for solving real-life problems using data.

Course Objectives:

1. By the end of this course, the students will be able to:
2. To introduce the classification and representation of different types of data using MS Excel for effective data organization and analysis.
3. To enable students to apply Excel functions to perform probability calculations and construct discrete and continuous probability distributions.
4. To develop the ability to apply statistical techniques such as sampling, correlation, and regression analysis using Excel for real-world datasets.
5. To equip students with the skills to formulate and test statistical hypotheses using Excel for informed, data-driven decision-making.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Demonstrate the ability to categorize and represent various types of data in MS Excel using appropriate formats and classifications
CO2	Apply Excel functions such as BINOM.DIST, NORM.DIST, and POISSON.DIST to compute and interpret probabilities from binomial, normal, and Poisson distributions.
CO3	Perform basic statistical analyses in Excel, including sampling techniques, correlation analysis, and linear regression, and interpret the results with real-world relevance.
CO4	Formulate statistical hypotheses and describe appropriate data collection methods to validate the hypotheses using Excel as a tool for data-driven decision making.
CO5	Use Excel to create scatter plots and add trendlines.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3	2			2				2		
CO2	3	3		3	2						
CO3	3	3		3	2	1					
CO4	2	3		3	2	2					
CO5	2	2			3				2		

Assessment Scheme:
Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
CA1	25
MSE	--
CA2	25
OE	50

CA1 and **CA2** are based on Surprise test/ Assignment/ Quiz/Seminar/Group discussions presentation, etc.

Course Contents

Practical No.	List of Experiments	Hours
1	**Data Categorization and Representation in Excel:** Create a simple dataset in MS Excel with 20 generic entries (e.g., "Customer ID", "Transaction Amount", "Product Category", "Customer Rating"). For each quantitative variable, classify it as discrete or continuous. For qualitative variables, identify their types. Briefly explain how you would format these different data types in Excel cells.	**02**
2	**Constructing a Probability Distribution in Excel:** Consider a generic discrete random variable (e.g., the number of successful attempts in 5 trials where each trial has a 50% chance of success). In MS Excel, list all possible outcomes for this variable. For each outcome, calculate its theoretical probability and display this as a Probability Mass Function (PMF) table.	**02**
3	**Binomial Probabilities with Excel:** A generic process has a known success rate (e.g., 30% of emails sent are opened). If you send 15 emails, use MS Excel's BINOM.DIST function to calculate the	**02**

	probability of: (a) exactly 4 emails being opened, (b) at most 3 emails being opened. Clearly show the Excel formulas used.	
4	**Normal Distribution Calculations in Excel:** Assume a dataset of generic measurements (e.g., component lifespans, delivery times) follows a normal distribution with a given mean (e.g., 100 units) and standard deviation (e.g., 15 units). Use MS Excel's NORM.DIST function to calculate the probability of a measurement being: (a) less than 90 units, (b) greater than 110 units.	**02**
5	**Poisson Probabilities with Excel:** A call center receives an average of 8 calls per hour during a certain period. Using MS Excel's POISSON.DIST function, calculate the probability of receiving: (a) exactly 5 calls in the next hour, (b) more than 10 calls in the next hour.	**02**
6	**Sampling Concepts for Data Analysis:** Imagine a large "population" of 1000 generic data points (e.g., customer ratings, product prices). Explain why it's often impractical to analyze the entire population. Define what a "sample" would be in this context and explain why we use samples for inference. No Excel calculation, but explain how you'd represent a small sample in Excel.	**02**
7	**Simple Random Sampling in Excel:** Create a list of 20 generic items or IDs in MS Excel (e.g., product codes, student IDs). Use Excel's RAND () and RANK () functions (or a similar method involving sorting by random numbers) to select a simple random sample of 5 items without replacement. Document the steps you performed in Excel.	**02**
8	**Calculating Correlation in Excel:** Enter a small dataset of 10 paired observations for two generic variables (e.g., "Temperature" and "Ice Cream Sales" or "Study Hours" and "Exam Score") into MS Excel. Use Excel's CORREL function to calculate Karl Pearson's coefficient of correlation between these two variables. Interpret the strength and direction of the relationship.	**02**
9	**Simple Linear Regression Line in Excel:** Create a scatter plot in MS Excel. Add a trendline to the scatter plot and display its equation and R squared value on the chart. Interpret the meaning of the slope and intercept of the regression line in the context of your generic data.	**02**
10	**Formulating Hypotheses for Testing:** For two generic claims about data (e.g., "The average response time of a system is exactly 3 seconds," or "A new marketing strategy increases sales by more than 10%"), formulate the appropriate Null Hypothesis (H0) and Alternative Hypothesis (H1). Briefly (in text within Excel or a	**02**

	comment) describe what kind of sample data you would collect in Excel to test each hypothesis.	

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	Basic Statistics	B. L. Agarwal	New Age International
2	Statistical Methods	S. P. Gupta	Sultan Chand & sons
3	Fundamentals of Mathematical Statistics	S. C. Gupta and V. K. Kapoor	Sultan Chand & sons
4	Statistics (Theory & Practice)	R S N Pillai	S.Chand Limited

Useful Links:
https://www.youtube.com/watch?v=xxpc-HPKN28
https://www.statology.org/tutorials/
https://www.tutorialspoint.com/statistics/index.htm
https://www.khanacademy.org/math/statistics-probability

Title of the Course Development of Life Skills Lab Course Code: 25BVD1205L	L	T	P	Credit
	--	--	2	1

Course Prerequisite:

1. Basic Communication Skills: Students should possess basic communication skills, including verbal and non-verbal communication, to effectively participate in life skills development activities.
2. Self-Awareness and Motivation: Students should have a basic understanding of themselves, including their strengths, weaknesses, and motivations, to benefit from life skills development exercises.
3. Basic Interpersonal Skills: Students should be able to interact with others, including peers and instructors, in a respectful and professional manner, to engage in group activities and discussions.

Course Description:

The Development of Life Skills Lab is a practical and interactive course designed to equip B.Voc students with essential life skills, enabling them to excel in their personal and professional lives. Through a series of engaging activities, exercises, and group discussions, students will develop critical skills such as communication, teamwork, time management, problem-solving, and leadership. This lab-based course focuses on experiential learning, allowing students to reflect on their experiences, identify areas for improvement, and develop strategies for personal growth and development. By the end of the course, students will be confident, self-aware, and equipped with the skills necessary to navigate the challenges of the modern workplace and beyond.

Course Objectives:

By the end of this course, the students will be able to:

1. Effective Communication Skills: Ability to communicate effectively, both verbally and non-verbally, in personal and professional settings.
2. Self-Awareness and Emotional Intelligence: Understanding of oneself, including strengths, weaknesses, and emotions, to make informed decisions and build strong relationships.
3. Problem-Solving and Critical Thinking Skills: Ability to analyze problems, identify solutions, and make informed decisions in personal and professional contexts.
4. Teamwork and Leadership Skills: Ability to work collaboratively in teams, build strong relationships, and demonstrate leadership skills to achieve common goals.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Develop and maintain healthy relationships with peers, colleagues, and mentors.
CO2	Analyse problems in personal and professional contexts.
CO3	Collaborate with others, build strong teams, and contribute to problem solving and decision making for achieving common goals.
CO4	Take initiative, lead others, and demonstrate leadership skills in personal and professional settings.
CO5	Recognize, manage, and regulate stress and emotions to maintain well-being and achieve goals.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1						2	3		3		
CO2		3		3						2	
CO3				3			3		2		2
CO4				3			2		2		3
CO5	1					3				2	

Assessment Scheme:
Two components of in semester evaluation (CA1 and CA2) having 50% weightage each.

Assessment Component	Marks
CA1	25
MSE	--
CA2	25
OE	50

CA1 and **CA2** are based on Assignment/Declared test/Quiz/Seminar/Group discussions/presentation, etc.
POE is based on the practical examination carried out at the end of the semester.

Course Contents

Practical No.	List of Experiments	Hours
1	Life Skill: Self-Awareness Assignment: Create a Self-Map showing your strengths, weaknesses, values, hobbies, and future goals. Documentation: Paste your diagram and write a short reflection on what you discovered about yourself.	**02**
2	Life Skill: Empathy Assignment: Interview an elder (e.g., grandparent or neighbor) about their school life and challenges. Documentation: Write a one-page summary describing what you learned and how it changed your perspective.	**02**
3	Life Skill: Critical Thinking Assignment: Analyze a social media post or advertisement. Identify facts, opinions, and any bias. Documentation: Use a table to list your observations with a short note on your conclusion.	**02**
4	Life Skill: Creative Thinking Assignment: Select a common household	**02**

	item (e.g., bottle, spoon, etc.). Brainstorm and list at least 10 completely new and unconventional uses for this object. Documentation: Include a drawing or photo of your idea with a paragraph explaining the new use.	
5	Life Skill: Decision Making Assignment: Choose a real-life dilemma (e.g., "Should I eat pizza or go to movie?"). Make a T-chart listing pros/cons of each option. Documentation: The chart and your final decision with a reason.	**02**
6	Life Skill: Problem Solving Assignment: Identify a small, everyday problem you notice in your school (e.g., litter in the playground, crowded hallways, difficulty finding a specific book in the library). Clearly state the problem. Then, brainstorm and list at least three possible solutions. For each solution, list potential steps to implement it and any resources needed. Documentation: State the problem and list your solutions with implementation steps and resources.	**02**
7	Life Skill: Effective Communication Assignment: Create a meme about a college issue (e.g., homework, recycling) with a clear call-to-action. Why? Uses humor to communicate ideas. Documentation: A meme and 2-sentence explanation.	**02**
8	Life Skill: Interpersonal Relationships Assignment: Write a gratitude note to someone who helped you (teacher, friend, parent). Deliver it in person/email and note their reaction. Documentation: A copy of the note and a reflection on their response.	**02**
9	Life Skill: Coping with Stress Assignment: Identify two common stressors in your daily life (e.g., homework, exams, social pressure). For each stressor list 5 calming or relaxing activities. Documentation: Make a colourful chart and explain how each activity helps you manage stress.	**02**
10	Life Skill: Coping with Emotions Assignment: Draw a wheel with 4 emotions you felt this week (e.g., joy, frustration). For each, note what triggered it and how you responded. Documentation: The wheel diagram and a short note.	**02**

Text Books			
Sr. No.	**Title**	**Author**	**Publisher**
1	Life Skills Education	Dr. K. Ravikanth Rao and Dr. P. Dinakar	Neelkamal publication, 2016
2	Life Skill Education	Gourav Mahajan	Shipra Publications, 2022
3	Life Skill Education	Dr. Rajeshkumar I. Bhatt	Notion Press, 2017

Useful Links:
https://www.franklincovey.com/the-7-habits/
https://www.danielgoleman.info/topics/emotional-intelligence/
https://open.lib.umn.edu/businesscommunication/

Title of the Course: NIE/ITS/Q15008 Data Analysis Assistant Course Code: 25BVD1206	L	T	P	Credit
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Course Prerequisite:

1. Basic I.T. Skills
2. Communication skills.

Course Description:

Junior Software Developer course 1) Basic I.T. Skills offers students, the opportunity to explore and develop their careers through professional practice. The structured plan of education impacts student work readiness through several professional development skill-building activities, including goal setting; analysis and reflection; feedback from employer; informational interviewing and briefing their experience.

Course Objectives:

By the end of this course, the students will be able to:

1. To provide practical exposure to the students.
2. To bridge the gap between theory and practical.
3. To foster professional development.
4. To provides hands-on experience and practices.

Course Outcomes:

CO	After the completion of the course the student should be able to
CO1	Apply theoretical knowledge while working practically
CO2	Acquire industry-specific skills
CO3	Enhance problem-solving and critical thinking skill
CO4	Develop a deeper understanding of the industry
CO5	Gain industry insights and networking opportunities

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011
CO1	3		3	2							
CO2			3		3			3			3
CO3		3	3	3							
CO4	3		3			3		3			
CO5							3		3		3

Assessment Scheme:
Two components of in semester evaluation (CA1 and CA2) having 50% weightage each.

Assessment Component	Marks
CA1	50
MSE	--
CA2	50
OE	100

CA1 and **CA2** are based on practical performance etc.

Useful Links:
https://www.sscnasscom.com/qp-qpservices