



ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ದಾವಣಗೆರೆ

DAVANGERE UNIVERSITY, DAVANGERE

BACHELOR OF COMPUTER SCIENCE

B.Sc

National Education Policy - 2020

(NEP-2020)

Syllabus for Bachelor of Science (B.Sc.) in Computer Science

(III & IV Semester)

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DEPARTMENT OF STUDIES IN COMPUTER SCIENCE


BOS Chairman
Dept. of Computer Science
Davangere University
Shivagangothri, Davangere
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Curriculum Structure for B.Sc.

SEMESTER-III										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC3	21BSC3C3CS1L	Object Oriented Programming Concepts and Programming in JAVA	40	60	100	4	-	-	4	2
	21BSC3C3CS1P	JAVA Lab	20	30	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	20	30	50	1	-	2	2	1
OEC3	21BSC3O3CS5	Electronic Commerce	40	60	100	3	-	-	3	2

SEMESTER-IV										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC4	21BSC4C2CS2L	Database Management Systems	40	60	100	4	-	-	4	2
	21BSC4C2CS2P	DBMS Lab	20	30	50	-	-	4	2	3
OEC4	21BSC4O3CS7	Python Programming Concepts	40	60	100	3	-	-	3	2


DEAN


Registrar
Davangere University
Shivangotri, Davangere

Syllabus for BSc (Basic and Honors), Semesters III

Semester: III

Course Title: Object Oriented Programming Concepts and Programming in Java	Course code:21BSC3C3CS1L DSC3
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (CO's):

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

- Explain the object-oriented concepts and JAVA.
- Write JAVA programs using OOP concepts like Abstraction, Encapsulation, Inheritance and Polymorphism.
- Implement Classes and multithreading using JAVA.
- Demonstrate the basic principles of creating Java applications with GUI.

DSC3: Object Oriented Programming Concepts and Programming in Java

Unit	Description	Hours
1	Introduction to Java: OOP paradigm , Basics concepts of OOP, applications and benefits of OOP, Java programming- History and evolution of java, basic structure, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.	14
2	Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, Vectors , wrapper classes, File, this reference.	14
3	Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package. Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exceptional handling mechanism. Exception handling with try, catch and finally.	14
4	Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle.	14

References:

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition, McGraw Hill Publication.
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall.
3. Object Oriented Programming with Java: Somashekara M.T., Guru, D.S., Manjunatha K.S, 1st Edition, PHI Learning 2017.
4. Java 2 - The Complete Reference – McGraw Hill Publication.
5. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill Publication, 2017.

Year	II	Course Code: 21BSC3C3CS1P	Credits	02
Sem.	III	Course Title: JAVA Lab	Hours	52
Formative Assessment Marks: 20		Summative Assessment Marks: 30		Duration of ESA: 03 hrs.

PART-A

1. Write a Programs using Different Control Structures (switch, if, shile, do, for etc.,)
2. Write a Programs using Arrays.
3. Write a Programs using Strings, String Buffer Classes and Vectors.
4. Write a Programs using constructor and destructor
5. Creation of classes and use Polymorphism feature.
6. Count the number of objects created for a class using static member function
7. Write a programs on Interfaces
8. Write a programs on Abstract classes.
9. Write a programs on packages
10. Write a programs using method overloading
11. Write a programs using method overriding
12. Write a programs on Multilevel Inheritance

PART-B

1. Write a program using same class name in different Packages
2. Write a program using exception handling mechanism.
3. Write a programs using AWT.
4. Write a Programs to create various GUI components
5. Write a Program on Text Fields and Areas
6. Write a Program on Windows and Menus (buttons, check boxes & labels)
7. Write a program multiple Inheritance with finally Keyword
8. Write a program to read & display content of plain text files.
9. Write a Multi-threading program & explore all built-in methods of threads
10. Write a program to append an element to the end of collection linked list & display the content.
11. Write a programs to display "Hello Java Beans" using JavaBean class.
12. Write a program to display using built-in functions of Vector.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Skill Enhancement Course: SEC2 for B.Sc. & other Branch Students

SEC Model-2

Semester: III

Course Title: Artificial Intelligence	Course Credits: 2
Total Contact Hours: 13 hours of theory and 26 hours of practical	Duration of ESA: 01 Hour
Formative Assessment Marks: 20 marks	Summative Assessment Marks: 30 marks

Course Outcomes (COs):

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

- Appraise the theory of Artificial intelligence and list the significance of AI.
- Discuss the various components that are involved in solving an AI problem.
- Illustrate the working of AI Algorithms in the given contrast.
- Analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
- Apply the AI concepts to build an expert system to solve the real-world problems.

Course Content

Unit - 1	
Overview of AI: Definition of Artificial Intelligence, Philosophy of AI, Goals of AI, Elements of AI system, Programming a computer without and with AI, AI Techniques, History of AI. Intelligent Systems: Definition and understanding of Intelligence, Types of Intelligence, Human Intelligence vs Machine Intelligence.	05
Unit – 2	
AI Applications: Virtual assistance, Travel and Navigation, Education and Healthcare, Optical character recognition, E-commerce and mobile payment systems, Image based search and photo editing. AI Examples in daily life: Installation of AI apps and instructions to use AI apps.	05
Unit – 3	
Robotics: Introduction to Robotics, Difference in Robot System and Other AI Program, Components of a Robot.	03

Laboratory Activities:

- Amazon Alexa:
<https://play.google.com/store/apps/details?id=com.amazon.dee.app&hl=en&am p:gl=US>
- Google Lens:
<https://play.google.com/store/search?q=google+lens&c=apps&hl=en&gl=US>
- Image to Text to Speech ML OCR:
https://play.google.com/store/apps/details?id=com.mlscanner.image.text.speech&hl=en_I N&gl=US
- Google Pay:
https://play.google.com/store/apps/details?id=com.google.android.apps.nbu.paisa.user&hl =en_IN&gl=US
- Grammarly:
https://play.google.com/store/search?q=grammarly&c=apps&hl=en_IN&gl=US
- Google Map:
<https://play.google.com/store/search?q=google+maps&c=apps&hl=en&gl=US>
- FaceApp:
https://play.google.com/store/apps/details?id=io.faceapp&hl=en_IN&gl=US
- Socratic:
https://play.google.com/store/apps/details?id=com.google.socratic&hl=en_IN&gl =US
- Google Fit: Activity Tracking:
https://play.google.com/store/apps/details?id=com.google.android.apps.fitness&hl =en_IN&gl=US
- SwiftKey Keyboard:
<https://swiftkey-keyboard.en.uptodown.com/android>
- E-commerce App:
https://play.google.com/store/apps/details?id=com.jpl.jiomart&hl=en_IN&gl=US

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Text Books:

1. Wolfgang Ertel, "Introduction to Artificial Intelligence", Second Edition, Springer International Publishing 2017.
2. Michael Negnevitsky, "Artificial Intelligence A Guide to Intelligent Systems", Second Edition, Pearson Education Limited 2005.

References:

1. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_tutorial.pdf
2. Kevin Knight, Elaine Rich , Shivashankar B. Nair, "Artificial Intelligence" ,Third Edition, July 2017.

Reference Links:

1. Voice Assistant: <https://alan.app/blog/voiceassistant-2/>
2. Browse with image: <https://www.pocket-lint.com/apps/news/google/141075-what-is-google-lens-and-how-does-it-work-and-which-devices-have-it>
3. OCR: <https://aws.amazon.com/what-is/ocr/>
4. Mobile Payment system: <https://gocardless.com/en-us/guides/posts/how-do-mobile-payment-systems-work/>
5. Grammarly: <https://techjury.net/blog/how-to-use-grammarly/#gref>

6. Travel & Navigation: <https://blog.google/products/maps/google-maps-101-ai-power-new-features-io-2021/>
7. AI in photo editing: <https://digital-photography-school.com/artificial-intelligence-changed-photo-editing/>
8. AI in education: <https://www.makeuseof.com/what-is-google-socratic-how-does-it-work/>
9. AI in health and fitness: <https://cubettech.com/resources/blog/implementing-machine-learning-and-ai-in-health-and-fitness/>
10. E-commerce and online shopping: <https://medium.com/@nyxonedigital/importance-of-e-commerce-and-online-shopping-and-why-to-sell-online-5a3fd8e6f416>

Open Elective for III Semester
ELECTRONIC COMMERCE: OEC3

Course Title: E-Commerce	Course Credits: 3 (3L+0T+0P)
Semester: III	Duration of SEE: 02 Hour
Total Contact Hours: 42	SEE: 60 Marks IA: 40 Marks

Course Outcomes:

- Compare how internet and other information technologies support business processes.
- Demonstrate an overall perspective of the importance of application of internet technologies in business administration
- Explain the basic business management concepts.
- Demonstrate the basic technical concepts relating to E-Commerce.
- Identify the security issues, threats and challenges of E-Commerce.

UNIT I Introduction to E-Commerce and Technology

14 Hrs

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5. **Infrastructure Building an E-Commerce Website:** Systematic approach to build an E-Commerce: Planning, System Analysis, System Design, Building the system, Testing the system, Implementation and Maintenance, Optimize Web Performance – Choosing hardware and software – Other E-Commerce Site tools

UNIT II Mobile Site and Apps ,E-Commerce Security and Payment Systems

14 Hrs

Developing a Mobile Website and Mobile App. E-Commerce Security Environment – Security threats in E-Commerce – Technology Solutions: Encryption, Securing Channels of Communication, Protecting Networks, Protecting Servers and Clients – Management Policies, Business Procedure and Public Laws- Payment Systems.

UNIT III Business Concepts in E-Commerce

14 Hrs

Digital Commerce Marketing and Advertising strategies and tools – Internet Marketing Technologies – Social Marketing – Mobile Marketing – Location based Marketing – Ethical, Social and Political Issues in E-Commerce. **Project Case Study:** Case Study: Identify Key components, strategy, B2B, B2C Models of E-commerce Business model of any e-commerce website - Mini Project: Develop E-Commerce project in any one of Platforms like Woo-Commerce, Magento or Opencart.

TEXT BOOK:

1. Kenneth C.Laudon, Carol Guercio Traver —E-Commerce, Pearson, 10th Edition, 2016

REFERENCES:

1. <http://docs.opencart.com/>
2. <http://devdocs.magento.com/>
3. <http://doc.prestashop.com/display/PS15/Developer+tutorials>
4. Robbert Ravensbergen, —Building E-Commerce Solutions with Woo Commerce, PACKT, 2nd Edition

Syllabus for BSc (Basic and Honors), Semesters IV

Course Title: Database Management System	Course code: 21BSC4C2CS2L DSC4
Total Contact Hours: 56	Course Credits: 03
Formative Assessment Marks: 40	Duration of SEE/Exam: 02 Hours
Summative Assessment Marks: 60	

Course Outcomes (CO's):

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

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database using DBMS.
- Demonstrate a Data model and Schemas in RDBMS.
- Identify entities and relationships and draw ER diagram for a given real-world problem.
- Convert an ER diagram to a database schema and deduce it to the desired normal form.
- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
- Explain the transaction processing and concurrency control techniques.

DSC7: Database Management System (DBMS)

Unit	Description	Hours
1	Database Architecture: Introduction to DBMS, database system vs. file system, applications of DBMS. Characteristics and Purpose of database approach. People associated with Database system. Data models. Database schema. Database architecture. Data independence. Database languages, interfaces, and classification of DBMS.	14
2	E-R Model: Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute. Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E -R diagram.	14
3	Relational Data Model: Relational model concepts. Characteristics of relations. Relational model constraints: Domain constraints, key constraints, primary & foreign key constraints, integrity constraints and null values.	14

	Relational Algebra: Basic Relational Algebra operations. Set theoretical operations on relations. JOIN operations Aggregate Functions and Grouping. Nested Sub Queries-Views. SQL: Background, Basic structure, set operation, aggregate functions, NULL values, sub queries, views in SQL. Introduction to PL/SQL, data types, identifiers, operators and expressions, conditional statements, iterative statements.	
4	Data Normalization: Anomalies in relational database design. Decomposition. Functional dependencies. Normalization. First normal form, Second normal form, Third normal form. Boyce-Codd normal form. Transaction Management: Introduction Transaction Processing. Single user & multiuser systems. Transactions: read & write operations. Desirable properties (ACID properties) of Transactions.	14
References: <ol style="list-style-type: none"> 1. Ramez Elamassri, Shankant B. Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2015 2. Bipin Desai, An Introduction to Database Systems, Galgotia Publications, 2010. 3. C J Date: Introduction to Database System 4. Abraham Silberschatz, Henry Korth, S.Sudarshan, Database Systems Concepts, 6th Edition, McGraw Hill, 2010. 5. Raghu Rama Krishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2002 		

Year	II	Course Code: 21BSC4C2CS2P	Credits	02																												
Sem.	IV		Hours	52																												
		Course Title: DBMS Lab																														
Formative Assessment Marks: 20		Summative Assessment Marks: 30	Duration of ESA: 03 hrs.																													
Practical's:		CO: Student would be able to create tables, execute queries and PL/SQL programs.																														
<div>Part A</div> <div>1. Create a table called Employee with the following structure.</div> <table><tr><th>Name</th><th>Type</th></tr><tr><td>Empno</td><td>Number</td></tr><tr><td>Ename</td><td>Varchar2(20)</td></tr><tr><td>Job</td><td>Varchar2(20)</td></tr><tr><td>Mgr</td><td>Number</td></tr><tr><td>Salary</td><td>Number</td></tr></table> <div>a. Add a column commission with domain to the Employee table. b. Insert any five records into the table. c. Update the column details of job d. Rename the column of Employ table using alter command. e. Delete the employee whose empno is 19.</div> <div>2. Create department table with the following structure.</div> <table><tr><th>Name</th><th>Type</th></tr><tr><td>Deptno</td><td>Number</td></tr><tr><td>Deptname</td><td>Varchar2(20)</td></tr><tr><td>location</td><td>Varchar2(20)</td></tr></table> <div>a. Add column designation to the department table. b. Insert values into the table. c. List the records of emp table grouped by deptno. d. Update the record where deptno is 9. e. Delete any column data from the table.</div> <div>3. Create a table called Customer table</div> <table><tr><th>Name</th><th>Type</th></tr><tr><td>Cust. name</td><td>Varchar2(20)</td></tr><tr><td>Cust. street</td><td>Varchar2(20)</td></tr><tr><td>Cust. city</td><td>Varchar2(20)</td></tr></table> <div>a. Insert records into the table. b. Add salary column to the table. c. Alter the table column domain. d. Drop salary column of the customer table. e. Delete the rows of customer table whose cust. city is 'CTA'</div>					Name	Type	Empno	Number	Ename	Varchar2(20)	Job	Varchar2(20)	Mgr	Number	Salary	Number	Name	Type	Deptno	Number	Deptname	Varchar2(20)	location	Varchar2(20)	Name	Type	Cust. name	Varchar2(20)	Cust. street	Varchar2(20)	Cust. city	Varchar2(20)
Name	Type																															
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Name	Type																															
Cust. name	Varchar2(20)																															
Cust. street	Varchar2(20)																															
Cust. city	Varchar2(20)																															

4. Create a table called branch table.

Name	Type
Branch name	Varchar2(20)
Branch city	varchar2(20)
Asserts	Number

- Increase the size of data type for asserts to the branch.
- Add and drop a column to the branch table.
- Insert values to the table.
- Update the branch name column
- Delete any two columns from the table
- Delete the row of the table with some condition.

QUERIES USING DDL AND DML

- Create a user and grant all permissions to the user.
 - Insert the any three records in the employee table and use rollback. Check the result.
 - Add primary key constraint and not null constraint to the employee table.
 - Insert null values to the employee table and verify the result.
- Create a user and grant all permissions to the user.
 - Insert values in the department table and use commit.
 - Add constraints like unique and not null to the department table.
 - Insert repeated values and null values into the table.
- Create a user and grant all permissions to the user.
 - Insert values into the table and use commit.
 - Delete any three records in the department table and use rollback.
 - Add constraint primary key and foreign key to the table.

QUERIES USING AGGREGATE FUNCTIONS

- By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
 - Display lowest paid employee details under each department.
 - Display number of employees working in each department and their department number.
 - Using built in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above.
 - List all employees which start with either B or C.
 - Display only these ename of employees where the maximum salary is greater than or equal to 5000.
- Calculate the average salary for each different job.
 - Show the average salary of each job excluding manager.
 - Show the average salary for all departments employing more than three people.
 - Display employees who earn more than the lowest salary in department 30
 - Show that value returned by sign (n) function.

	<p>f. How many days between day of birth to current date.</p> <p>10. a. Show that two substring as single string. b. List all employee names, salary and 15% rise in salary. c. Display lowest paid emp details under each manager d. Display the average monthly salary bill for each deptno. e. Show the average salary for all departments employing more than two people. f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary.</p> <p>11. a. Count the number of employees in department 20 b. Find the minimum salary earned by clerk. c. Find minimum, maximum, average salary of all employees. d. List the minimum and maximum salaries for each job type. e. List the employee names in descending order. f. List the employee id, names in ascending order by empid. g. Delete any three records in the department table and use rollback. h. Add constraint primary key and foreign key to the table.</p> <p>12. a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and not null.</p> <p>13. a. Create a user and grant all permissions to the user. b. Update the table reserves and use savepoint and rollback. c. Add constraint primary key , foreign key and not null to the reservestable d. Delete constraint not null to the table column.</p>
	<p style="text-align: center;">Part B:</p> <p>PROGRAMS ON PL/SQL</p> <p>1. a. Write a PL/SQL program to swap two numbers. b. Write a PL/SQL program to find the largest of three numbers.</p> <p>2. a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade. b. Write a PL/SQL program to find the sum of digits in a given number.</p> <p>3. a. Write a PL/SQL program to display the number in reverse order. b. Write a PL / SQL program to check whether the given number is prime or not.</p> <p>4. a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area.</p> <p>5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When „hello“ passed to the program it should display „Hll“ removing e and o from the word Hello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in words.</p>

PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a given year.
3. Create a function to find the factorial of a given number and hence find NCR.
4. Write a PL/SQL block o pint prime Fibonacci series using local functions.
Create function to the reverse of given number.

CURSORS

1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees.
2. Write a PL/SQL block that will display the employee details along with salary using cursors.
3. To write a Cursor to display the list of employees who are working as a Managers or Analyst.
4. To write a Cursor to find employee with given job and deptno.
5. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the „employee" table are updated. If none of the employee's salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in „employee" table.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Open Elective for IV Semester
Python Programming Concepts: OEC4

Course Title: Python Programming Concepts	Course Credits: 3 (3L+0T+0P)
Semester: IV	Duration of SEE: 02 Hour
Total Contact Hours: 42	SEE: 60 Marks IA: 40 Marks

Course Outcomes:

- Explain the fundamentals of Computers.
- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and the creation of functions.
- Identify the methods to create and store strings.

UNIT I Fundamentals of Computers

14 Hrs

Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translators: Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples.

UNIT II Python Basics

14 Hrs

Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples; Illustrative programs. **Python Control Flow:** Types of Control Flow; Control Flow Statements- if, else, else if, while loop, break, continue statements, for loop Statement; range() and exit () functions; Illustrative programs.

UNIT IV Python Functions & Strings

14 Hrs

Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Illustrative programs.

Strings: Creating and Storing Strings; Accessing String Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods; Illustrative programs.

REFERENCES

1. Computer Fundamentals (BPB), P. K. Sinha & Priti Sinha
2. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition, Green Tea Press. Freely available online 2015.
@<https://www.greenteapress.com/thinkpython/thinkCSpy.pdf>
3. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
4. <http://www.ibiblio.org/g2swap/byteofpython/read/>
5. http://scipy-lectures.org/intro/language/python_language.html
6. <https://docs.python.org/3/tutorial/index.html>


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