

# दिल्ली विश्वविद्यालय UNIVERSITY OF DELHI

Generic Electives: Computer Science Papers

(Effective from Academic Year 2019-20)



**Revised Syllabus as**

**approved by**

**Academic Council**

Date:

No:

**Executive Council**

Date:

No:

**Applicable for students registered with Regular Colleges, Non Collegiate Women's  
Education Board and School of Open Learning**

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## **Preamble**

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The University of Delhi envisions all its programmes in the best interest of their students and in this endeavour it offers a new vision to all its Under-Graduate courses. It imbibes a Learning Outcome-based Curriculum Framework (LOCF) for all its Under Graduate programmes.

The LOCF approach is envisioned to provide a focused, outcome-based syllabus at the undergraduate level with an agenda to structure the teaching-learning experiences in a more student-centric manner. The LOCF approach has been adopted to strengthen students' experiences as they engage themselves in the programme of their choice. The Under-Graduate Programmes will prepare the students for both, academia and employability.

Each programme vividly elaborates its nature and promises the outcomes that are to be accomplished by studying the courses. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for employability. In short, each programme prepares students for sustainability and life-long learning.

The new curriculum of Generic Electives (Computer Science) offers a flavour of computer science and applications to students who do not have an opportunity to study these subject as either major or minor subjects in their curriculum in University of Delhi.

The University of Delhi hopes the LOCF approach of the programme Generic Electives (Computer Science) will help students in making an informed decision regarding the goals that they wish to pursue in further education and life, at large.

## **1. Introduction to Generic Electives (Computer Science Department)**

Generic elective of Computer Science and Applications are designed to impart flavour of computer science and computer applications to the students who do not have an opportunity to study these subject either major or minor subjects in their curriculum. The courses are designed for students studying BA/BSc (Hons) programme, and those studying BA/BCom. (Non-Hons) programme of University of Delhi.

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## **2. Credit Distribution for Generic Electives (Computer Science Department)**

All Generic Elective courses are 6 credit courses with breakup of 4 credits for theory to be taught in 4 hours per week, and 2 credits for 4 hours of laboratory work per week.

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## **3. Semester-wise Distribution of Courses.**

As per the UGC curriculum for undergraduate courses, BA/BSc (Hons) programme students study generic electives in Semester **I, II, III** and **IV**. The semester is amply reflected in the course code. The first number in the course code indicates the semester in which the course will be offered. For example, course **CSGE1XX** is offered in Semester **I**, and is for students studying BA/BSc (Hons) programme.

BA/BCom (Non-Hons) programme students study generic electives in Semester **V** and **VI**. The first number in the course code indicates the semester in which the course will be offered. For example, course **CSGE5XX** is offered in Semester **V** for those studying BA/BCom (Non-Hons) programme.

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## **4. Generic Elective Courses: Computer Science for Hons Courses**

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**Programming using Python (CSGE101) Generic Elective - (GE)**

**Credit: 06**

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## Course Objective

This course is designed as the first course that introduces computers and programming to non-Computer Science students. The course focuses on the use of computer and programming to solve problems of different domains. It also introduces the concept of object-oriented programming.

## Course Learning Outcomes

On successful completion of the course, students will be able to:

1. Describe the components of a computer and notion of an algorithm.
2. Apply suitable programming constructs and built-in data structures to solve a problem.
3. Develop, document, and debug modular python programs.
4. Use classes and objects in application programs and visualize data.

## Detailed Syllabus

### Unit 1

**Computer Fundamentals and Problem Solving:** Basic Computer Organization: CPU, memory, I/O Units. Problem solving using computer, notion of an algorithm.

### Unit 2

**Introduction to Python Programming:** Python interpreter/shell, indentation; identifiers and keywords; literals, numbers, and strings; operators (arithmetic operator, relational operator, Boolean operator, assignment, operator, ternary operator and bitwise operator) and expressions

### Unit 3

**Creating Python Programs:** Input and output statements, defining functions, control statements (conditional statements, loop control statements, break, continue and pass, exit function.), default arguments, errors and exceptions.

### Unit 4

**Strings and Lists:** String class, built-in functions for string, string traversal, string operators and operations; Lists creation, traversal, slicing and splitting operations, passing list to a function

### Unit 5

**Object Oriented Programming:** Introduction to Classes, Objects and Methods, Standard Libraries, File handling through libraries.

### Unit 6

**Built-in data structures:** Tuples, sets, dictionary, stacks, and queues; searching and sorting.

### Practicals

1 Execution of expressions involving arithmetic, relational, logical, and bitwise operators in the shell window of Python IDLE.

2. Write a Python function to produce the outputs such as:

(a)           1  
              21  
              321  
              4321

b)            1  
              121  
              12321  
              1234321  
              12321  
              121  
              1

3. Write a Python program to illustrate the various functions of math module.
4. Write a Python program to produce a table of sines, cosines and tangents. Make a variable  $x$  in range from 0 to 10 in steps of 0.2. For each value of  $x$ , print the value of  $\sin(x)$ ,  $\cos(x)$  and  $\tan(x)$ .
5. Write a program that reads an integer value and prints “leap year” or “not a leap year”
6. Write a menu driven program to calculate the area of given building. Accept suitable inputs and use suitable assertions.
7. Write a Python function that takes a number as an input from the user and computes its factorial.
8. Write a Python function to generate the Fibonacci sequence till a given number “ $n$ ”.
9. Write a function that takes a number as an input and finds its reverse and computes the sum of its digits.
10. Write a function that takes two numbers as input parameters and returns their least common multiple.

11. Write a function that takes a number as an input and determine whether it is prime or not.
12. Write a function that finds the sum of the
  - a) first n odd terms
  - b) first n even terms
  - c) 1, 2, 4, 3, 5, 7, 9, 6, 8, 10, 11, 13.. till n-th term
13. Write a Python function that takes a string as an input from the user and determines whether it is palindrome or not.
14. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
15. Write a Python function that prints a dictionary where the keys are numbers between 1 and 5 and the values are cubes of the keys.
16. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
  - a. Print half the values of tuple in one line and the other half in the next line.
  - b. Print another tuple whose values are even numbers in the given tuple.
  - c. Concatenate a tuple t2=(11,13,15) with t1.
  - d. Return maximum and minimum value from this tuple.
17. Write a function called “check\_duplicates” that takes a list and returns true if there is any element that appears more than once. Also find the frequency of that element. The original list should not be modified.
18. Write a program to implement a class for finding area and perimeter of a rectangle. Write constructor, destructor, and functions for calculating area and perimeter.
19. Write a menu driven program to perform the following functions on strings:
  - a. Find the length of string
  - b. Return maximum of three strings
  - c. Accept a string and replace every successive character with ‘#’ Example-  
For Given string ‘Hello World’ returned string is ‘H#l#o W#r#d’.
  - d. Find number of words in the given string
20. Write a Python program to perform the following using list:
  - a. Check if all elements in list are numbers or not
  - b. If it is a numeric list, then count number of odd values in it
  - c. If list contains all Strings, then display largest String in the list

- d. Display list in reverse form
  - e. Find a specified element in list
  - f. Remove the specified element
21. Usage of Python debugger tool-pydb and PythonTutor.
  22. Implementation of Linear and binary search techniques
  23. Implementation of selection sort, insertion sort, and bubble sort techniques

## References

1. Guttag, J.V. (2016). *Introduction to computation and programming using Python*. 2nd edition. MIT Press.
2. Taneja, S., Kumar, N. (2018). *Python Programming- A modular Approach*. Pearson Education India.

## Additional Resources

1. Kamthane, A. N., & Kamthane, A.A. (2017) *Programming and Problem Solving with Python*, McGraw Hill Education.
2. Liang, Y. D. (2013). *Introduction to Programming using Python*. Pearson Education.

## Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class-room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Computer Fundamentals and Problem Solving: Basic Computer Organization: CPU, memory, I/O Units, Problem solving using computer, notion of an algorithm
3	Python interpreter/shell, indentation; identifiers and keywords; Creating Python Programs: Input and output statements, defining functions, literals, numbers, and strings;
4	Operators: arithmetic operators, relational operators, boolean operators, assignment operators, ternary operator and bitwise

	operator and expressions
5	Control statements (conditional statements, loop control statements,
6	Break, continue and pass, exit function, default arguments
7	Errors and exceptions
8	Strings and Lists: String class, built-in functions for string, string traversal, string operators and operations;
9	Lists creation, traversal, slicing and splitting operations, passing list to a function
10	Object Oriented Programming: Introduction to Classes, Objects and Methods,
11	Standard Libraries, File handling through libraries
12-13	Built-in data structures: Tuples, sets, dictionary, stacks, and queues
14-15	searching and sorting

### **Assessment Methods**

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

### **Keywords**

Computer Hardware Organization, Problem solving for computer programming, Object oriented programming, Python

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## **Database Management System (CSGE201) Generic Elective - (GE)**

**Credit: 06**

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### **Course Objectives**

The course introduces the concepts of database management systems to students, focusing on basics such as the importance and significance of a database, data model, schema creation and normalization.

### **Course Learning Outcomes**

On successful completion of the course, students will be able to:

1. Describe the features of database management systems.
2. Differentiate between database systems and file systems.
3. Model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.
4. Write queries in relational algebra / SQL.
5. Normalize a given database schema.

## Detailed Syllabus

### Unit 1

**Introduction:** Introduction to database, relational data model, DBMS architecture, data independence and data abstraction, DBA, database users, end users, front end tools

### Unit 2

**Data Modelling:** Entity types, entity set, attribute and key, relationships, relation types, ER diagrams, database design using ER diagrams

### Unit 3

**Relational Data Model:** Relational model concepts, relational constraints, primary and foreign key, candidate key, alternate, composite, super-key.

### Unit 4

**Data redundancy, Normalization:** 1NF, 2NF, 3NF.

### Unit 5

**Structured Query Language:** Introduction to SQL, concepts of Data Definition Language (DDL) and Data Manipulation Language (DML), DDL queries like create a data base, drop a database, create table, drop table, alter table, DML queries like inserting data in a table, update in a table, delete data from a table, filter data.

### Unit 6

**Structured Query Language (continued..):** Create relationships between database tables, auto increment, check, Null values, aggregate functions - min, max, count, average, sum, nested sub-queries, group by, having, exists, case, order by. Join operations - inner, left join, right join, natural join and Cartesian product. Overview of forms and reports.

#### Practicals:

1. Create a database having two tables with the specified fields, to computerize a library system of a Delhi University College.

LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price)

IssuedBooks (Accession number, Borrower)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Delete the record of book titled “Database System Concepts”.
- c) Change the Department of the book titled “Discrete Maths” to “CS”.
- d) List all books that belong to “CS” department.
- e) List all books that belong to “CS” department and are written by author “Navathe”.
- f) List all computer (Department = “CS”) that have been issued.
- g) List all books which have a price less than 500 or purchased between “01/01/1999” and “01/01/2004”.

2. Create a database having three tables to store the details of students of Computer Department in your college, as per the given schema.

Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)  
Paper Details (Paper code, Name of the Paper)  
Student’s Academic and Attendance details (College roll number, Paper code, Attendance, Marks in home examination).

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
- c) List all students who live in “Delhi” and have marks greater than 60 in paper 1.
- d) Find the total attendance and total marks obtained by each student.
- e) List the name of student who has got the highest marks in paper 2.

3. Create the following tables and answer the queries given below:

Customer (CustID, email, Name, Phone, ReferrerID)  
Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)  
BicycleModel (ModelNo, Manufacturer, Style)  
Service (StartDate, BicycleID, EndDate)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) List all the customers who have the bicycles manufactured by manufacturer “Honda”.
- c) List the bicycles purchased by the customers who have been referred by customer “C1”.
- d) List the manufacturer of red colored bicycles.
- e) List the models of the bicycles given for service.

4. Create the following tables, enter at least 5 records in each table and answer the queries given below.

EMPLOYEE ( Person\_Name, Street, City )

WORKS ( Person\_Name, Company\_Name, Salary )  
COMPANY ( Company\_Name, City )  
MANAGES ( Person\_Name, Manager\_Name )

- a) Identify primary and foreign keys.
- b) Alter table employee, add a column “email” of type varchar(20).
- c) Find the name of all managers who work for both Samba Bank and NCB Bank.
- d) Find the names, street address and cities of residence and salary of all employees who work for “Samba Bank” and earn more than \$10,000.
- e) Find the names of all employees who live in the same city as the company for which they work.
- f) Find the highest salary, lowest salary and average salary paid by each company.
- g) Find the sum of salary and number of employees in each company.h) Find the name of the company that pays highest salary.

5. Create the following tables, enter at least 5 records in each table and answer the queries given below.

Suppliers (SNo, Sname, Status, SCity)  
Parts (PNo, Pname, Colour, Weight, City)  
Project (JNo, Jname, Jcity)  
Shipment (Sno, Pno, Jno, Qunatity)

- a) Identify primary and foreign keys.
- b) Get supplier numbers for suppliers in Paris with status>20.
- c) Get suppliers details for suppliers who supply part P2. Display the supplier list in increasing order of supplier numbers.
- d) Get suppliers names for suppliers who do not supply part P2.
- e) For each shipment get full shipment details, including total shipment weights.
- f) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
- g) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
- h) Get the names of cities that store more than five red parts.
- i) Get full details of parts supplied by a supplier in London.
- j) Get part numbers for part supplied by a supplier in London to a project in London.
- k) Get the total number of project supplied by a supplier (say, S1).
- l) Get the total quantity of a part (say, P1) supplied by a supplier (say, S1).

## References

1. Bayross, I. (2010) *SQL, PL/SQL the Programming Language of Oracle*. 4th edition. BPB Publications.
2. Elmasri, R., & Navathe, S.(2017). *Fundamentals of Database Systems*. 7th edition. Pearson Education.
3. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2011), *Database System Concepts*. 6th edition. Tata McGraw-Hill Education.

### Additional Resources

1. Date, C.J., Kanman, A. & Swamynathan, S. (2006). *An Introduction to Database Systems*. 8th edition. Pearson Education.
2. Ramakrishnan, R. Gehrke, J. (2014), *Database Management Systems*. 3rd edition. Tata McGraw Hill Education.
3. MWidenius, M., Axmark, D., Cole, J., Lentz, A., & Dubois, P. (2002). *MySQL Reference Manual*. O'Reilly Community Press.

### Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class- room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1	Introduction: Introduction to database, relational data model,
2-3	DBMS architecture, data independence and data abstraction, DBA, database users, end users, front end tools
4-5	Data Modeling: Entity types, entity set, attribute and key, relationships, relation types, E-R diagrams, database design using ER diagrams
6-7	Relational Data Model: Relational model concepts, relational constraints, Primary and foreign key, candidate key, alternate, composite, superkey
8	Data redundancy, Normalization: 1NF, 2NF, 3NF.
9	Introduction to SQL, concepts of Data Definition Language (DDL) and Data Manipulation Language (DML),
10	DDL commands to create a data base, drop a database, create table, drop table, alter table
11	DML commands to inserting data in a table, update in a table, delete data from a table,
12	Create relationships between database tables, auto increment, check, Null values,
13	SQL queries to filter data, Group by, having, exists, case, order by

14	SQL queries for aggregate functions - min, max, count, average, sum, nested sub-queries, Join operations - inner, left join, right join, natural join, Cartesian product.
15	Overview of Forms and Reports.

### **Assessment Methods**

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

### **Keywords**

Databases, E-R diagrams, normalization, structured query language

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## **Computer Networks (CSGE301) Generic Elective - (GE)**

**Credit: 06**

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### **Course Objective**

This course covers the fundamental concepts of computer networks, standard models of computer networks having layered architecture, data communication, network topologies, web technologies and internet applications.

### **Course Learning Outcomes**

On successful completion of this course, a student will be able to:

1. State the use of computer networks and different network topologies.
2. Distinguish between LAN, MAN, WAN, and between Intranet, Extranet and Internet.
3. Compare OSI and TCP/IP architectures
4. Enumerate different transmission media and describe the use of each of them.
5. Design web pages using HTML.

### **Detailed Syllabus**

#### **Unit 1**

**Computer Networks:** Introduction to computer network, data communication, components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet, extranet.

## **Unit II**

**Network Models:** Client/ server network and Peer-to-peer network, OSI, TCP/IP, layers and functionalities.

## **Unit III**

**Transmission Media:** Introduction, Guided Media: Twisted pair, Coaxial cable, Optical fiber. Unguided media: Microwave, Radio frequency propagation, Satellite.

## **Unit IV**

**LAN Topologies:** Ring, bus, star, mesh and tree topologies. Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router.

## **Unit V**

**Internet Terms:** Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline. Internet Applications: www, telnet, ftp, e-mail, social networks, search engines, Video Conferencing, e-Commerce, m-Commerce, VOIP, blogs.

## **Unit VI**

**Introduction to Web Design:** Introduction to hypertext mark-up language (html), Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration. Customized Features: Cascading style sheet (CSS) for text formatting and other manipulations.

## **Practical**

Networking exercises in a trial lab, where effects of different connectors, topologies in practical could be demonstrated.

Before moving to JavaScript practicals, students must get an idea about fundamental programming using Scratch (<https://scratch.mit.edu>). Students should be encouraged to learn Scratch on their own and work on assignments available online such as <https://sites.google.com/site/christopherscfahs/scratch-programming/scratch-assignments> or <http://scratched.gse.harvard.edu/resources/uw-catapult-project>.

Alternatively, students may use Alice (<http://www.alice.org/index.php>) and learn basic programming. A lot of online assignments and spoken tutorials on YouTube would be helpful.

Practical exercises based on concepts listed in theory using HTML.

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking text as well as marquee text.
2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table:

			<b>Some image here</b>	

4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student’s name and Grades in a tabular form.
6. Create an HTML document (having two frames) which will appear as follows:

About Department 1 Department 2 Department 3	This frame would show the contents according to the link clicked by the user on the left frame.
-------------------------------------------------------	-------------------------------------------------------------------------------------------------

7. Create an HTML document containing horizontal frames as follows:

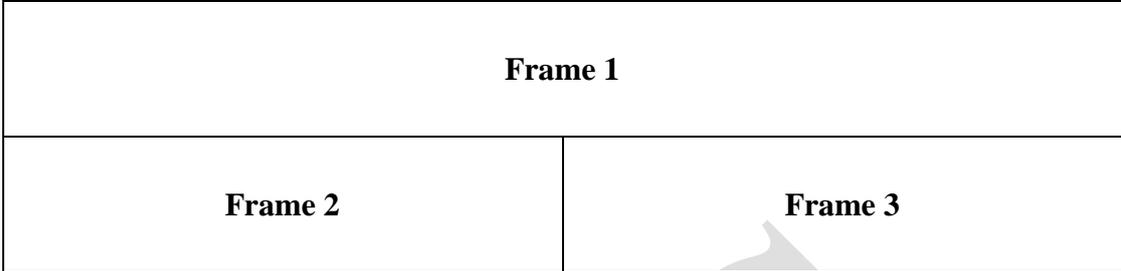
Department Names (could be along with Logos)
Contents according to the Link clicked

8. Create a website of 6 – 7 pages with different effects as mentioned in above problems.

9. Create HTML documents (having multiple frames) in the following three formats:

Department Names (could be along with Logos)
----------------------------------------------

Contents according to the Link clicked



10. Create a form using HTML which has the following types of controls:

- I. Text Box
- II. Option/radio buttons
- III. Check boxes
- IV. Reset and Submit buttons

### Subscribe to XYZ News Magazine and Emails

Interested in receiving daily small updates of all latest News? Well, now you can. And best of all, it is free! Just fill out this form and submit it by clicking the "send it In" button. We will put you on our mailing list and you will receive your first email in 3-5 days.

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Please fill the following boxes to help us send the emails and our news letter:

First Name:

Last Name:

Business:

We must have a correct e-mail address to send you the news letter:

Email:

How did you hear about XYZ News Magazine and Emails?

Here on the Web    In a magazine    Television    Other

Would you like to be on our regular mailing list?

Yes, we love junk emails

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**References**

1. Forouzan, B.A. (2017). *Data Communication and Networking*, McGraw-Hill Education.
2. Powell, T.A. (2010). *HTML & CSS: The Complete Reference*. 5th edition. Tata McGraw-Hill.

**Additional Resources**

1. Minnick, J. (2015). *Web Design with HTML5 and CSS3*. 8th edition. Cengage Learning.

2. Stallings, W. (2017), *Data and Computer Communications*. 10th edition. Pearson Education India.
3. Tanenbaum, A.S. & Wethrall, D. J.(2012). *Computer Networks*, Pearson Education.

### Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class-room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Introduction to computer network, data communication, components of data communication, Data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet, extranet
3	Network Models: Client/ server network and Peer-to-peer network
4-5	OSI Model, TCP/IP, layers and functionalities.
6-7	Transmission Media: Guided Media: Twisted pair, Coaxial cable, Optical fiber, Unguided media: Microwave, Radio frequency propagation, Satellite
8	LAN Topologies: Ring, bus, star, mesh and tree topologies.
9	Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router.
10	Internet Terms: Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline
11	Introduction to Web Design: Introduction to hypertext markup language (html) Document type definition, creating web pages, lists,
12	Hyperlinks, tables, web forms
13	Inserting images, Frames, hosting options and domain name registration
14	Customized Features: Cascading style sheet (css) for text formatting and other manipulations.

**Assessment Methods**

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

**Keywords**

network topologies, data communication, OSI model, TCP/IP model, HTML, web design.

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**Information Security and Cyber Laws (CSGE401) Generic Elective - (GE)****Credit: 06**

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**Course Objectives**

This course introduces the students to the concepts of information security and different type of attacks in the cyber space. The course also introduces countermeasures to mitigate attacks and different existing cyber laws.

**Course Learning Outcomes**

On successful completion of the course, students will be able to:

1. Learn, structure, mechanics and evolution of various crime threats
2. Learn to protect information systems from external attacks by developing skills in enterprise security, wireless security and computer forensics.
3. Analyse the risks involved while sharing their information in cyber space and numerous related solutions like sending protected and digitally signed documents
4. Insights of ethical hacking and usage of password cracking tools
5. Get an overview of different ciphers used for encryption and decryption.

**Detailed Syllabus****Unit 1**

**Definitions** :Protection, Security, risk, threat, vulnerability, exploit, attack, confidentiality, integrity, availability, non-repudiation, authentication , authorization, codes, plain text, encryption, decryption, cipher text, key, ciphers, Symmetric and asymmetric

cryptography, Public key , private key ,Crypt analysis,, Cyber forensics. Substitution cipher (Caesar), Transposition cipher (Rail-Fence),

## **Unit 2**

Risk analysis, process, key principles of conventional computer security, security policies, data protection, access control, internal vs external threat, security assurance, passwords, access control, computer forensics and incident response.

## **Unit 3**

CYBER ATTACKS (definitions and examples): Denial-of-service attacks, Man-in-the-middle attack, Phishing, spoofing and spam attacks, Drive-by attack, Password attack, SQL injection attack, Cross-site scripting attack, Eavesdropping attack, Birthday attack, Malware attacks, Social Engineering attacks

## **Unit 4**

Brief Introduction of handling the attacks described in UNIT 3. Firewalls, logging and intrusion detection systems, e-mail security, security issues in operating systems, ethics of hacking and cracking.

## **Unit 5**

Definitions: Digital Signature and Electronic Signature, Digital Certificate

- i.[Section 43] Penalty and compensation for damage to computer etc.
- ii.[Section 65] Tampering with computer source documents
- iii.[Section 66A] Punishment for sending offensive messages through communication service etc.
- iv.[Section 66B] Punishment for dishonestly receiving stolen computer resource or communication device
- v.[Section 66C] Punishment for identity theft
- vi.[Section 66D] Punishment for cheating by impersonation by using computer resource
- vii.[Section 66E] Punishment for violation of privacy
- viii.[Section 66F] Punishment for cyber terrorism
- ix.[Section 67] Punishment for publishing or transmitting obscene material in electronic form
- x.[Section 67A] Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form
- xi.[Section 67B] Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form
- xii.[Section 72] Breach of confidentiality and privacy

## **Unit 6**

Brief introduction of IT infrastructure in India, National agencies handling IT.

## Practical

1. Demonstrate the use of Network tools: ping, ipconfig, ifconfig, tracert, arp, netstat, whois
2. Use of Password cracking tools : John the Ripper, Ophcrack. Verify the strength of passwords using these tools.
3. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.
4. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations.
5. Use nmap/zenmap to analyse a remote machine.
6. Use Burp proxy to capture and modify the message.
7. Demonstrate sending of a protected word document.
8. Demonstrate sending of a digitally signed document.
9. Demonstrate sending of a protected worksheet.
10. Demonstrate use of steganography tools.
11. Demonstrate use of gpg utility for signing and encrypting purposes.

## References

1. Merkow, M., & Breithaupt, J.(2005) *Information Security Principles and Practices*. 5th edition. Prentice Hall.
2. Snyder, G.F. (2010). *Network Security*, Cengage Learning.
3. Whitman, M. E. & Mattord, H. J. (2017) *Principles of Information Security*. 6th edition. Cengage Learning.

## Additional Resources:

1. Basta, A., & Halton, W., (2010) *Computer Security: Concepts, Issues and Implementation*, Cengage Learning India.
2. Anderson, R. (2008) *Security engineering: A guide to building dependable Distributed Systems*. 2nd edition. John Wiley & Sons.

## Web Resources:

1. <https://blog.netwrix.com/2018/05/15/top-10-most-common-types-of-cyber-attacks/>
2. <https://www.ibef.org/industry/infrastructure-sector-india.aspx>

## Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Definitions : Protection , Security, risk, threat, vulnerability, exploit, attack, confidentiality, integrity, availability, non-repudiation, authentication, authorization, codes, plain text, encryption, decryption, cipher text, key, ciphers, Symmetric and asymmetric cryptography
3	Public key, private key, Crypt analysis, Cyber forensics. Substitution cipher (Caeser), Transposition cipher (Rail-Fence)
4	Risk analysis, process, key principles of conventional computer security, security policies
5-6	Data protection, access control, internal vs external threat, security assurance, Passwords, access control, computer forensics and incident response
7-8	Cyber attacks, types and examples)
9	Brief Introduction of handling the attacks described in UNIT 3.
10	Firewalls, logging and intrusion detection systems, e-mail security
11	Security issues in operating systems, ethics of hacking and cracking.
12-14	Digital Signature and Electronic Signature, Digital Certificate, Penalty and compensation, Punishment for various attacks
15	Brief introduction of IT security infrastructure in India. National agencies handling IT security.

## Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

## Keywords

Information security, cyber laws, risk analysis, attacks.

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## **5. Generic Elective Courses: Computer Applications for Non Hons Courses**

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### **IT Fundamentals (CSGE501) Generic Elective - (GE)**

**Credit: 06**

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#### **Course Objectives**

This course introduces the students to the basic concepts of computers. The aim is to bridge the fundamental concepts of computers with the present level of knowledge of the students. The course also aims to skill the students so that they can make use of information technology effectively in all walks of life.

#### **Course Learning Outcomes**

On successful completion of this course, students will be able to:

1. develop a vocabulary of key terms related to the computer and to software program menus, identify the components of a personal computer system and use the interface deftly.
2. organize files and documents on storage devices.
3. compose, format and edit a word document.
4. use spreadsheet for storing data and performing preliminary analysis.
5. acquire fundamental knowledge of networking and distinguish between different types of networks.
6. acquire knowledge of internet applications and use them.

#### **Detailed Syllabus**

##### **Unit 1**

**Introduction:** Introduction to logical organization of computer, input and output devices, keyboard, mouse, joystick, scanner, OCR, OMR, monitor, Printer, Plotter.

##### **Unit 2**

**Storage Devices:** Primary memory, secondary memory, auxiliary memory.

##### **Unit 3**

**User Interface:** Operating system as user interface, system tools, control panel settings.

## Unit 4

**Database:** Introduction to database, use of spreadsheet as database, use of functions and database operations in spreadsheet.

## Unit 5

**Networks:** Definition of network, classification of network, LAN, MAN, WAN, distinction among networks.

## Unit 6

**Internet Applications:** Internet as a global network, Internet utilities – email, online banking, reservations etc.

## Practical

### Text Editor

1. Prepare a grocery list having four columns (Serial number, The name of the product, quantity and price) for the month of April, 06.

- Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
- The headings of the columns should be in 12-point and bold.
- The rest of the document should be in 10-point Times New Roman.
- Leave a gap of 12-points after the title.

2. Create a telephone directory. • The heading should be 16-point Arial Font in bold

- The rest of the document should use 10-point font size
- Other headings should use 10-point Courier New Font.
- The footer should show the page number as well as the date last updated.

3. Design a time-table form for your college.

- The first line should mention the name of the college in 16-point Arial Font and should be bold.
- The second line should give the course name/teacher's name and the department in 14-point Arial.
- Leave a gap of 12-points.
- The rest of the document should use 10-point Times New Roman font.
- The footer should contain your specifications as the designer and date of creation.

4. BPB Publications plans to release a new book designed as per your syllabus. Design the first page of the book as per the given specifications.

- The title of the book should appear in bold using 20-point Arial font.
- The name of the author and his qualifications should be in the center of the page in 16-point Arial font.
- At the bottom of the document should be the name of the publisher and address in 16-point Times New Roman.
- The details of the offices of the publisher (only location) should appear in the footer.

5. Create the following one page documents.
  - a. Compose a note inviting friends to a get-together at your house, Including a list of things to bring with them.
  - b. Design a certificate in landscape orientation with a border around the document.
  - c. Design a Garage Sale sign.
  - d. Make a sign outlining your rules for your bedroom at home, using a numbered list.
  
6. Create the following documents:
  - a. A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.
  - b. Use a newsletter format to promote upcoming projects or events in your classroom or college.
  
7. Convert the given text to a table, using comma as delimiter .
  
8. Create a table in the document with the given number of rows and columns and fill different type of data in cells. Align text data as instructed, set the format of number data as describe.
  
9. Enter data into a table given below.

<b>Salesperson</b>	<b>Dolls</b>	<b>Trucks</b>	<b>Puzzles</b>

Sort the table as instructed.

10. Wrapping of text around the image.
11. Create your resume by incorporating suitable text formatting options.
12. Following features of menu option must be covered :

FILE  
 EDIT  
 VIEW  
 INSERT  
 FORMAT  
 TABLE  
 WINDOW  
 HELP  
 TOOLS

Complete menu  
 All options except Online  
 collaboration, Tools on Macro,  
 Templates

## Spread sheet

1. Enter the data in Excel Sheet, as per the following structure

### REGIONAL SALES PROJECTION

State	Qtr1	Qtr2	Qtr3	Qtr4	Qtr Total	Rate	Amount	Total average
-------	------	------	------	------	-----------	------	--------	---------------

- (a) Apply Formatting as follow:

- i. Title in TIMES NEW ROMAN
- ii. Font Size - 14
- iii. Remaining text - ARIAL, Font Size -10
- iv. State names and Qtr. Heading Bold, Italic with Gray Fill Color.
- v. Numbers in two decimal places.
- vi. Qtr. Heading in center Alignment.
- vii. Apply Border to whole data.

- (b) Calculate State and Qtr. Total

- (c) Calculate Average for each quarter

- (d) Calculate Amount = Rate \* Total.

2. Given the following worksheet

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
1	Roll No.	Name	Marks	Grade
2	1001	Sachin	99	
3	1002	Sehwag	65	
4	1003	Rahul	41	
5	1004	Sourav	89	
6	1005	Har Bhajan	56	

Calculate the grade of these students on the basis of following guidelines:

If Marks	Then Grade
$\geq 80$	A+
$\geq 60$	< 80 A
$\geq 50$	< 60 B
< 50	F

2. Given the following worksheet for storing salesman(alphanumeric) and sales for four quarters.

Salesman	Sales(in INR)					
No.	Qtr1	Qtr2	Qtr3	Qtr4	Total Sales	Commission

Calculate the commission earned by the salesman on the basis of following candidates:

If Total Sales	Commission
< 20000	0% of sales
> 20000 and < 25000	4% of sales
> 25000 and < 30000	5.5% of sales
> 30000 and < 35000	8% of sales
>= 35000	11% of sales

The total sales is sum of sales of all the four quarters.

4. A company XYZ Ltd. pays a monthly salary to its employees which consists of basic salary, allowances & deductions. The details of allowances and deductions are as follows:

#### Allowances

- HRA Dependent on Basic
  - 30% of Basic if Basic  $\leq$  1000
  - 25% of Basic if Basic  $>$  1000 & Basic  $\leq$  3000
  - 20% of Basic if Basic  $>$  3000
- DA Fixed for all employees, 30% of Basic
- Conveyance Allowance Rs. 50/- if Basic is  $\leq$  1000  
Rs. 75/- if Basic  $>$  1000 & Basic  $\leq$  2000  
Rs. 100 if Basic  $>$  2000
- Entertainment Allowance NIL if Basic is  $\leq$  1000  
Rs. 100/- if Basic  $>$  1000

#### Deductions

- Provident Fund 6% of Basic
- Group Insurance Premium Rs. 40/- if Basic is  $\leq$  1500  
Rs. 60/- if Basic  $>$  1500 & Basic  $\leq$  3000  
Rs. 80/- if Basic  $>$  3000

Calculate the following:

Gross Salary = Basic + HRA + DA + Conveyance + Entertainment

Total deduction = Provident Fund + Group Insurance Premium

Net Salary = Gross Salary – Total Deduction

5. Create Payment Table for a fixed Principal amount, variable rate of interests and time in the format below:

No. of Instalments	5%	6%	7%	8%	9%
1	XX	XX	XX	XX	XX
2	XX	XX	XX	XX	XX
3	XX	XX	XX	XX	XX
4	XX	XX	XX	XX	XX

6. Use an array formula to calculate Simple Interest for given principal amounts given the rate of Interest and time

Rate of Interest      8%  
 Time                      5 Years

Principal	Simple Interest	Compound Interest

7. The following table gives year-wise sale figure of ten salesmen in INR.

Salesman	2000	2001	2002	.....	2009
S1	....				
S2					
.					
.					
.					
.					

- Calculate total sale year wise.
- Calculate the net sale made by each salesman
- Calculate the maximum sale made by the salesman
- Calculate the commission for each salesman under the condition.
  - If total sales >4,00,000 give 5% commission on total sale made by the salesman.
  - Otherwise give 2% commission.
- Draw a bar graph representing the sale made by each salesman.13
- Draw a pie graph representing the sale made by salesman in 2000.

8. Design an Excel Sheet for storing the following data:

Expenses	Jan	Feb	March	Quarter Total	Quarter Average
Telephone	600	....	....		
Rent	50				
.	.				
.	.				
.	.				

Given, monthly income is 1,475 INR

- Calculate Quarter total and Quarter average.
- Calculate Monthly total.
- Surplus = Monthly income - Monthly total.
- What would be total surplus if monthly income is 1500.
- How much does telephone expense for March differ from quarter average.
- Create a 3D column graph for telephone and utilities.
- Create a pie chart for monthly expenses.

9. Create an excel sheet for storing revenue earned(yearly) as given in the following sample:

### TOTAL REVENUE EARNED FOR SAM'S BOOKSTALL

Publisher name	1997	1998	1999	2000	total
A	Rs. 1,000.00	Rs. 1100.00	Rs. 1,300.00	Rs. 800.00	
B	Rs. 1,500.00	Rs. 700.00	Rs. 1,000.00	Rs. 2,000.00	
C	Rs. 700.00	Rs. 900.00	Rs. 1,500.00	Rs. 600.00	
D	Rs. 1,200.00	Rs. 500.00	Rs. 200.00	Rs. 1,100.00	
E	Rs. 800.00	Rs. 1,000.00	Rs. 3,000.00	Rs. 560.00	

(a) Compute the total revenue earned.

(b) Plot the line chart to compare the revenue of all publisher for 4 years.

(b) Chart Title should be 'Total Revenue of sam's Bookstall (1997-2000)'

(c) Give appropriate categories and value axis title.

10. Generate 25 random numbers between 0 & 100 and find their sum, average and count.

How many no. are in range 50-60?

#### References

1. Goel, A. (2010). *Computer Fundamentals*, Pearson Education.

#### Additional Resources:

1. Aksoy, P. & Nardis, L. De. (2006), *Introduction to Information Technology*, Cengage Learning.

2. Sinha, P. K. (2007), *Fundamentals of Computers*, BPB Publishers.

#### Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class-room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Introduction: Introduction to logical organization of computer, input and output devices like keyboard, mouse, joystick, Scanner, OCR, OMR, Monitor, Printer, Plotter, (with connections and practical demo),
5	Storage Devices: Primary memory, secondary memory, Auxiliary memory
6-7	User Interface: Operating system as user interface

8	System tools, control panel settings
9	Introduction to database
10	Use of spreadsheet as database, use of functions
11	Database operations in spreadsheet.
12-13	Networks: Definition of network, classification of network, LAN, MAN, WAN, Distinction among networks
14-15	Internet Applications: Internet as a global network, Internet utilities – email, online banking, reservations etc

### Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

## Multimedia and Web Design (CSGE601) Generic Elective - (GE)

**Credit: 06**

### Course Objective

This paper aims to provide comprehensive review of concepts and techniques for designing and developing attractive websites with multimedia components.

### Course Learning Outcomes

On successful completion of the course, students will be able to:

- understand fundamental Web design principles and technologies.
- understand the detailed design plan required to create a successful Web site that considers audience needs, accessibility features, and various technical issues.
- understand the coverage of ownership, permissions, and copyright issues.
- incorporate text, images, animation, sound, and video into Web pages.
- create a website with popular multimedia authoring tools, such as Macromedia Flash.

### Detailed Syllabus:

#### Unit 1

**Introduction:** Definition of multimedia, Components, uses, applications

#### Unit 2

**Multimedia Input/ Output Devices:** Scanner, camera, microphone, speaker, monitors, printers

### Unit 3

**Multimedia Storage Devices:** CD ROMs, DVDs, Blue ray disk

### Unit 4

**Multimedia tools:** Sound editor, video editor, animator, authoring tools

### Unit 5

**Web Designing:** Concept of website, website as a communication resource, Internet, intranet and extranet, basic concepts related to website designing.

### Unit 6

**HTML:** Introduction to hypertext markup language, document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, inserting audio, video and animation; frames, use of CSS.

### Practical

Practical exercises based on concepts listed in theory using Presentation tools in office automation tool/ GIMP/Blender / Audacity/ Animation Tools/ Image Editors/ Video Editors. Implement the followings using Blender –

1. Create an animation using the tools panel and the properties panel to draw the following –  
Line, pie , oval, circle, rectangle , square, pencil , brush , lasso tool
2. Create an animation using text tool to set the font , size , color etc.
3. Create an animation using **Free transform tool** that should use followings-
  - Move Objects
  - Skew Objects
  - Stretch Objects
  - Rotate Objects
  - Stretch Objects while maintaining proportion
  - Rotate Objects after relocating the center dot
4. Create an animation using layers having following features-  
Insert layer, Delete layer, guide layer, Mask layer.
5. Modify the document (changing background color etc. )using the following tools :
  - Eraser tool
  - Hand tool
  - Ink bottle tool
  - Zoom tool
  - Paint Bucket tool
  - Eyedropper tool
6. Create an animation for bus car race in which both starts from the same point and car wins the race.

7. Create an animation in which text Hello gets converted into GoodBye (using motion/shape tweening).
8. Create an animation having five images having fade-in fade-out effect.
9. Create an scene to show the sunrise (using multiple layers and motion tweening)
10. Create an animation to show the ripple effect.
11. Create an animation (using Shape tweening and shape hints) for transforming one shape into another.
12. Create an animation for bouncing ball (you may use motion guide layer).

Project :

Design a minimum 10 page interactive website using Joomla or WordPress

### References

1. Ramalho, J. A. (2007) *Learn Advanced HTML 4.0 with DHTML*. BPB Publications.
2. Vaughan, T. (2014). *Multimedia: Making It Work*. 9th edition. McGraw Hill Education (India).

### Additional Resources

1. Minnick, J. (2015). *Web Design with HTML5 and CSS3*. 8th edition. Cengage Learning.
2. Stallings, W. (2017). *Data and Computer Communications*. 10th edition. Pearson Education India.
3. Tanenbaum, A.S. & Wethrall, D. J. (2012). *Computer Networks*. Pearson Education.

### Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1	Introduction: Definition of multimedia, Components, uses, applications
2	Multimedia Input/ Output Devices: Scanner, camera, Microphone, Speaker, Monitors, Printers
3	Multimedia Storage Devices: CD ROMs, DVDs, Blue ray disk
4	Multimedia tools: Sound editor, video editor

5	Multimedia tools: Animator, Authoring tools
6-7	Web Designing: Concept of website, website as a communication resource, Internet, intranet and extranet,
8	Basic concepts related to website designing.
9-11	HTML: Introduction to hypertext markup language (html) Document type definition, creating web pages,
12	lists, Hyperlinks, graphical elements
13	Tables, web forms
14	Inserting images, Frames, hosting options and domain name registration
15	Cascading style sheet (css)

### **Assessment Methods**

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

### **Keywords**

Multimedia, Website, HTML, CSS

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## **Data Science using R (CSGE602) Generic Elective - (GE)**

**Credit: 06**

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### **Course Objective**

Data Science also known as data driven science makes use of scientific methods, processes and systems to extract knowledge or insights from data in various forms (structured or unstructured). The study of these methods and processes is the main objective of the course.

### **Course Learning Outcomes**

On successful completion of the course, students will be able to:

1. create effective solutions to data analysis challenges.
2. effectively organize and manage data science projects.
3. analyse problems and identify solutions.
4. communicate data science problems, methods, and findings effectively, visually, and in writing.

## Detailed Syllabus

### Unit 1

**Introduction:** Introduction to Data Science, Data Science Basics, Need of Data Science, Life Cycle of Data Science, Challenges of Data Science Technology, Data Science Components, Applications of Data Science, Data Science Job Roles, Tools for Data Science, Structured Data, Unstructured Data.

### Unit 2

**R Programming Basics:** Overview of R, R data types and objects, Operators, Precedence and associativity, Decision Making, Loops, Functions, Scoping, File System, Reading and writing Data

### Unit 3

**Data Structures In R programming:** Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames.

### Unit 4

**Statistical Analysis:** Mean, Harmonic Mean, Median, Mode, Standard Deviation, Central tendency, measures of dispersion, Data Distribution, Analysis of Variance & covariance, Summary Function, Z score Function, Linear Regression analysis, Multiple Regression, Logistic regression.

### Unit 5

**Data Visualization:** Overview of Data Visualization, Pie Chart, Line Graphs, Bar Chart, Histogram, Box plot, Scatter Plot, Function plot, Animating objects using R.

### Unit 6

**Case Study:** Suitable Case Studies will be taken up. The list will be provided by the department in consultation with the college teachers in the beginning of the semester.

## Practical

Q1. Write an R script to do the following:

- a) Draw 10 random letters from the lowercase alphabet, and sort them alphabetically.
- b) Draw 5 random letters from each of the lowercase and uppercase alphabets, incorporating both into a single vector, and sort it alphabetically.
- c) Repeat the above exercise but sort the vector alphabetically in descending order.

Q2. Read a text file that contains sales of milk in litres for 15 days in three different shops (the first 3 values are for shops 1,2 and 3 on Monday, etc.). Produce a statistical summary of the sales for each day of the week and also for each shop.

Q3. Read the rainfall in cm of three different states S1, S2 and S3 from a CSV file. Write an R script to plot an appropriate graph to compare them using different colours. Label the graph, x-axis, y-axis and the legend.

Q4. Read a text file containing the monthly expenditure breakdown of an individual as {Housing, Food, Clothing, entertainment, Others}.

Write an R script to:

- a) represent monthly expenditure breakdown using a pie chart.
- b) represent the percentage of each expenditure using pie chart. Also, add chart legend to the graph.

Q5. Write an R script to do the following:

- a) Simulate a sample of 100 random data points from a normal distribution with mean 100 and standard deviation 5, and store the result in a vector.
- b) Plot a histogram and a boxplot of the vector you just created.
- c) Calculate the summary of the sample generated.
- d) Using the data above, test the hypothesis that the mean equals 100.
- e) Test the hypothesis that mean equals 90.

Use data set of your choice from Open Data Portal (<https://data.gov.in/>) for the following exercises.

Q6. Read the all rows from the CSV file, with header. Write an R script to:

- a) create a subset of the data records that satisfy a condition.
- b) find suitable descriptive statistics for each column.
- c) draw boxplot for the numeric attributes and identify outliers, if any
- d) find correlation for each pair of numeric attributes, and draw scatter plot matrix.
- e) draw histograms, pie charts for categorical attributes.
- f) draw the probability density curve for numeric attributes.

Projects and Case Studies to be done as decided by the department in the beginning of the semester.

## References

1. Wickham, H. R. & Golemund, G. (2017). *R for Data Science*. 1st edition. O'Reilly Media.

### Additional Resources

1. James,G., Written, D. , Hostie, T. & Tibshirani, R(2013). *Introduction to Statistical Learning*. Springer.
2. Rahif, T. (2017). *Data Visualization with R*. Springer.

### Web Resources

<https://www.r-project.org/>

<https://cran.r-project.org/>

### Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Introduction: Introduction to Data Science, Data Science Basics, Need of Data Science, Life Cycle of Data Science, Challenges of Data Science Technology, Data Science Components, Applications of Data Science, Data Science Job Roles, Tools for Data Science, Structured Data, Unstructured Data
3	Overview of R, R data types and objects, Operators, Precedence and associativity
4	Decision Making, Loops
5	Functions, Scoping
6	File System, Reading and writing Data.
7-9	Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames
10	Statistical Analysis: Mean, Harmonic Mean, Median, Mode, Standard Deviation, Central tendency, measures of dispersion
11	Data Distribution, Analysis of Variance & co-variance, Linear Regression analysis
12	Summary Function, Z score Function, Multiple Regression, Logistic regression.
13-15	Data Visualization: Overview of Data Visualization, Pie Chart, Line Graphs, Bar Chart, Histogram, Box plot, Scatter Plot,

	Function plot, Animating objects using R.
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### **Assessment Methods**

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

### **Keywords**

Data Science, functions, visualizations,

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## **Data Science using Python (CSGE603) Generic Elective - (GE)**

**Credit: 06**

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### **Course Objective**

Data Science also known as data driven science makes use of scientific methods, processes and systems to extract knowledge or insights from structured and unstructured data. This paper is designed to introduce the methods and processes of Data Science.

### **Course Learning Outcomes**

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

1. analyse and solve data science problems in real world projects.
2. effectively organize and manage data sets for data science projects.
3. use Python packages to perform statistical analysis of given dataset.
4. display data in suitable visual form.

### **Detailed Syllabus**

#### **Unit 1**

**Introduction:** Introduction to Data Science, Data Science Basics, Need of Data Science, Life Cycle of Data Science, Challenges of Data Science Technology, Data Science Components, Applications of Data Science, Data Science Job Roles, Tools for Data Science, Structured Data, Unstructured Data.

#### **Unit 2**

**Python Basics:** Overview of Python, data types, Operators, Precedence of operators, Decision Making, Loops, Functions, Scoping, Strings, Vectors, Lists, Matrices, Arrays, Factors, File System, reading and writing data.

#### **Unit 3**

**Data Structures in Python:** Lists, Tuples, Dictionaries, Introduction to Numpy, Arrays  
Creating and arrays Indexing, Data Processing using Arrays, About Pandas library.

#### Unit 4

**Statistical Analysis:** Mean, Harmonic Mean, Median, Mode, Standard Deviation, Central tendency, measures of dispersion, data Distribution, Analysis of Variance & co-variance, Linear Regression analysis.

#### Unit 5

**Data Visualization:** Overview of Data Visualization, Introduction to Matplot library, Line Plot, Bar Chart, Histogram, Box Plot, Scatter Plot, Function plot, animating the objects.

#### Practical

1. Find measures of central tendencies for the given data.
2. Draw the box plot for the given data and analyse skewness.
3. For the given data, plot the PDF.
4. Make visual representations of data using library Matplotlib and apply basic principles of data graphics to create rich analytic graphs for available datasets.
5. Randomly generate 30 numbers in the range of 1 to 40 and do the following
  - a) Generate box plot
  - b) Identify outliers, if any
  - c) Display 5 point summary of data distribution

Use data set of your choice from Open Data Portal (<https://data.gov.in/>) for the following exercises.

6. Read the all rows from the CSV file, with header. Write an R script to:
  - a) create a subset of the data records that satisfy a condition.
  - b) find suitable descriptive statistics for each column.
  - c) draw boxplot for the numeric attributes and identify outliers, if any
  - d) find correlation for each pair of numeric attributes, and draw scatter plot matrix.
  - e) draw histograms, pie charts for categorical attributes.
  - f) draw the probability density curve for numeric attributes.
7. Read the CSV file, without headers and
  - a. Find the number of records which are noise free
  - b. Clean data after removing noise
  - c. Normalize quantative features in range of [0,1]

Projects and Case Studies to be done as decided by the department in the beginning of the semester.

## References:

1. McKinney, W. (2017) *Python for Data Analysis: Data Wrangling With Pandas- Numpy And Ipython*, Oreilly Media.
2. Plas, J. V. (2019) *Data Science from Scratch: First Principles with Python*. 2nd edition. Oreilly.
3. VanderPlas, J. (2016). *Python Data Science Handbook*, O' Reilly Media, Inc.

## Additional References

1. Downy, A. B. (2004). *Think Python*. O'reilly.
2. Iliinsky, N., & Steele, J. (2011). *Designing Data Visualizations*. O' Reilly Media, Inc.
3. Taneja, S., Kumar, N., (2018). *Python Programming- A modular Approach*. Pearson Education

## Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class-room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Topics
1-2	Introduction: Introduction to Data Science, Data Science Basics, Need of Data Science, Life Cycle of Data Science, Challenges of Data Science Technology, Data Science Components, Applications of Data Science, Data Science Job Roles, Tools for Data Science, Structured Data, Unstructured Data
3	Overview of Python, data types, Operators, Precedence of operators
4	Decision Making, Loops,
5	Functions, Scoping,
6	Strings, Vectors
7	Lists, Matrices, Arrays
8	Factors, File System, reading and writing data.
9	Data Structures in Python: Lists, Tuples, Dictionaries, Introduction to Numpy
10	Arrays Creating and arrays Indexing, Data Processing using Arrays,

	About Pandas library
11	Statistical Analysis: Mean, Harmonic Mean, Median, Mode, Standard Deviation, Central tendency, measures of dispersion
12	Data Distribution, Analysis of Variance & co-variance, Linear Regression analysis
13-15	Data Visualization: Overview of Data Visualization, Introduction to Matplot library, Line Plot, Bar Chart ,Histogram, Box Plot, Scatter Plot, Function plot, animating the objects

### Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

### Keywords

Data Science, functions, visualizations,

## 6. Note on Practical

1. The size of the practical group for practical papers is recommended to be 10-15 students.
2. Each practical will carry 50 marks including 25 marks for continuous evaluation and 5 marks for the oral viva.
3. Colleges are advised and encouraged to conduct the practical using Free and Open Source Software (FOSS).
4. At least two questions have to be compulsorily attempted in the final practical examination.
5. Softcopy of all the practical must be maintained by each student for each practical paper.
6. Practical given for the courses are only indicative, and by no means exhaustive. Instructor may add more complex problems in laboratory depending on the ability of the students.