SGT University, Chandu-Budhera, Gurugram

Faculty of Engineering & Technology

Department of Computer Science &Engineering

Bachelor of Computer Applications

Scheme & Syllabus (2022-23 Onwards)

Vision of SGT University

"Driven by Research & Innovation, we aspire to be amongst the top ten Universities in the Country by 2025"

The syllabi of BCA program for all semesters are given in the following pages. These are arranged as semester-wise.

Three Year course BCA program at glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Total
Course	9	8	10	9	11	1	48
Credit	21	21	23	22	26	16	129

Scheme of studies:

Abbreviations:

* AECC - Ability Enhancement Compulsory Course

**VAC - Value Added Course

#MGE - Multidisciplinary Generic Elective

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1		Mathematics	3	1	-	4
2		Web Technologies	3	-	-	3
3		Computer Fundamentals	3	-	-	3
4		Programming Fundamentals	3	-	-	3
5		AECC -1*	2	-	-	2
6		VAC – 1**	2	-	-	2
7		Web Technologies Lab	-	-	2	1
8		Computer Fundamentals Lab	-	-	2	1
9		Programming Fundamentals Lab	-	-	4	2
TOTAL			16	1	8	21

SEMESTER II

S.No	Course Code	Course Title	L	T	P	C
1		Statistics	3	1	-	4
2		Web based Programming using PHP	3	-	-	3
3		Programming in Java	3	-	-	3
4		MGE-1#	4	-	-	4
5		AECC - 2*	2	-	-	2
6		VAC – 2**	2	-	-	2
7		Web based Programming using PHP Lab	-	-	2	1
8		Programming in Java Lab	-	-	4	2
TOTAL			**17**	**1**	**6**	**21**

*The students are compulsorily need to undergo 4 weeks of summer internship immediately after 2nd semester.

#After the completion of the first-year student is well-versed with the web application fundamentals including server-side scripting. Student is expected to be placed as web developers, and/or web administration in software industry or work independently as freelance web developer.

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Specialization - I	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		MGE – 2#	4	-	-	4
5		AECC – 3*	2	-	-	2
6		VAC – 3**	2	-	-	2
7		Data Structure and Algorithms Lab	-	-	4	2
8		Operating Systems Lab	-	-	2	1
9		Specialization-I Lab	-	-	2	1
10		Summer Internship-I	-	-	-	2
TOTAL			**17**	**0**	**8**	**23**

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Specialization - II	3	-	-	3
2		Computer Networks	3	-	-	3
3		Database Management Systems	3	1	-	4
4		MGE - 3#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		VAC – 4**	2	-	-	2
7		Database Management Systems Lab	-	-	4	2
8		Computer Networks Lab	-	-	2	1
9		Specialization – II Lab	-	-	2	1
TOTAL			**17**	**1**	**8**	**22**

*The students are compulsorily need to undergo 6 weeks of summer internship immediately after 4th semester.

#After the completion of the second-year student is capable of developing web applications, web administration, databases, and fundamentals of cloud computing or fundamentals of machine learning. Student is expected to be placed as application developer and system administrator in software industry.

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Specialization - III	3	-	-	3
2		Departmental Elective – I	3	-	-	3
3		Departmental Elective – II	3	-	-	3
4		Data Visualization and Story Telling	3	-	-	3
5		MGE – 4#	4	-	-	4
6		Specialization - III Lab	-	-	2	1
7		Departmental Elective -I Lab	-	-	2	1
8		Departmental Elective-II Lab	-	-	2	1
9		Data Visualization and Story Telling Lab	-	-	2	1
10		Mobile Application Development	-	-	4	2
11		Summer Internship-II	-	-	-	4
TOTAL			**16**	**0**	**12**	**26**

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Industrial Internship	-	-	-	16
TOTAL			**0**	**0**	**0**	**16**

Total Credits: 129

SPECIALIZATION

The students will have options of selecting the electives from the different baskets depending on the specialization they wish to acquire. Refer to Table 2 for list of subjects.

Table 2: List of subjects offered under various specializations

S.No.	Cloud Computing	Artificial Intelligence and Machine Learning	L	T	P	C
1	Cloud Computing	Artificial Intelligence	3	0	2	4
2	Cloud Computing Architecture and Deployment Models	Foundation of Machine Learning	3	0	2	4
3	Virtualization and Cloud Security	R programming for Data Analytics	3	0	2	4

Skill Enhancement Courses

The students will have options of selecting the electives from the different baskets given in Table 3 and Table 4.

Table 3: List of Departmental Electives offered under Cloud Computing specializations

S.No.	Course Name	L	T	P	C
1	Basics of Machine Learning	3	0	2	4
2	Basics of Data Analysis	3	0	2	4
3	Basics of Internet of Things	3	0	2	4

Table 4: List of Departmental Electives offered under AI-ML specializations

S.No.	Course Name	L	T	P	C
1	Cloud Computing	3	0	2	4
2	Data Mining	3	0	2	4
3	Basics of Internet of Things	3	0	2	4

The student has to choose one subject from the pool of university umbrella course offered under MGE, AECC and VAC respectively.

Semester – I

S.No	Course Code	Course Title	L	T	P	C
1		Mathematics	3	1	-	4
2		Web Technologies	3	-	-	3
3		Computer Fundamentals	3	-	-	3
4		Programming Fundamentals	3	-	-	3
5		AECC -1[*]	2	-	-	2
6		VAC – 1[**]	2	-	-	2
7		Web Technologies Lab	-	-	2	1
8		Computer Fundamentals Lab	-	-	2	1
9		Programming Fundamentals Lab	-	-	4	2
TOTAL			16	1	8	21

Semester – I

1.	**Name of the Department- Computer Science Engineering**						
2.	**Course Name**	**Mathematics**	**L**		**T**		**P**
3.	**Course Code**		**3**		**1**		**0**
4.	**Type of Course (use tick mark)**		**Core (✓)**		**PE()**		**OE ()**
5.	**Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
Lectures = 40			**Tutorials = 0**		**Practical = 0**		

8. Course Description

This course is to enable students to understand concepts of determinants and matrices such as addition, subtraction, multiplication, system of linear equation by Cramer's rule. This course is also designed to develop and solidify basic arithmetic series like Arithmetic Progression (A.P), Geometric Progression (G.P), and algebra skills that will be required in future math courses.

In this course also include differentiation topics: derivative of a function, polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions and Logarithmic Differentiation. Integration topics includes: Indefinite integrals, Methods of integration: by substitution, by parts, by partial fractions, Integration of algebraic and transcendental functions. Because of the basic concepts of differentiation and integration are very useful for solving simple application problems related to computer science based on these.

9. Learning objectives:

After completion of this course the students may capable to investigate the structure of real-world problems and plan solution strategies. They might be able to solve the problems using appropriate tools and develop a mathematical vocabulary by expressing mathematical ideas orally and in writing. Enhance and reinforce the student's understanding of concepts through the use of technology when appropriate.

10. Course Outcomes (COs):

a) Familiarity with Matrices and Determinants.

b) To determine general term of series in AP and GP, Calculate sum of n terms of series

c) To gain insight of differentiation and its applications

d) To gain insight of integeration and its applications

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Determinants and Matrices

Determinants: Definition, Minors, Co-factors, Properties of Determinants, Applications of determinants in finding area of triangle.

Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Solution of system of linear equation by Cramer's Rule.

Unit – 2	Number of lectures = 10	Sequences and Series

Sequence and Series: Introduction, Sequences, Series, Arithmetic Progression (A.P), Geometric Progression (G.P), Relationship Between A. M. and G.M., Sum to N terms of Special Series, Principle of Mathematical Induction.

Unit – 3	Number of lectures = 10	Differentiation

Differentiation: Derivative of a function, Derivatives of sum, differences, product, and quotient of functions, Derivative of polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions, Logarithmic Differentiation, Derivatives of functions in parametric forms, Differentiation by substitution.

Unit – 4	Number of lectures = 10	Integration

Integration: Indefinite integrals, Methods of integration: by substitution, by parts, by partial fractions, Integration of algebraic and transcendental functions.

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books

1. Shanti Narayan, Integral calculus, Sultan Chand & Co.
2. Shanti Narayan, Differential calculus, Sultan Chand & Company.
3. Babu Ram, Engineering Mathematics, Pearson Education

1. Name of the Department- Computer Science Engineering						
2. Course Name	Web Technologies	L		T		P
3. Course Code		3		0		0
4. Type of Course (use tick mark)		Core (✓)		PE()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

This course is an introduction to Web site development and the technologies behind it. Students will learn how to design and develop Web pages using current technologies and tools. Topics covered will include the World Wide Web, HTML, Cascading Style Sheets (CSS) and XML. The focus of this course is on dynamic HTML, a collection of web technologies such as HTML and scripting languages used together to create interactive and animated Web pages. Students will learn to program client-side scripts using JavaScript and the Document Object Model to transform static Web pages created with HTML and CSS into dynamic Web pages.

Learning objectives:

This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function. This will also expose students to the basic tools and applications used in Web publishing.

9. Course Outcomes (COs):

a) Create a well-designed and well-formed, professional Web site utilizing the most current standards and practices.

b) Create web pages using HTML and Cascading Style Sheets.

c) Build dynamic web pages using JavaScript (Client side programming).

d) Select appropriate Web tools for a Web development project

e) Build interactive web applications using AJAX.

10. Unit wise detailed content

Unit-1	Number of lectures = 10	

Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0, Common terminology: IP Addressing, URLs, Domain names. Website Creation and maintenance, Web Hosting and Publishing Concepts, Search Engines and their working.

HTML: Introduction to HTML, HTML Document structure tags, HTML comments, Text formatting, inserting special characters, anchor tag, adding images and sound, lists: types of lists, tables, frames and floating frames, Developing Forms, Image maps, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets.

Unit – 2	Number of lectures = 10	

Page Styling: Separation of content and presentation in HTML, Cascading Style Sheets - Types of Style Sheets – Internal, inline and External style sheets, customizing common HTML elements, types of CSS selectors.

Unit – 3	Number of lectures = 10	

Client-side scripting: JavaScript - Data Types, Control Statements, operators, Built-in and User Defined Functions, Objects in JavaScript, Handling Events. HTML Document Object Model.

AJAX –Introduction to AJAX programming, improving web page performance using AJAX.

Unit – 4	Number of lectures = 10	

Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation, Browser architecture and Web site structure.

11. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://nptel.ac.in/courses/106/105/106105084   (Prof. Indranil Sengupta, IIT, Kharagpur)

12. Books Recommended

Text Books

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford University Press

2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.

3. Web Technology, Rajkamal, Tata McGraw-Hill.

1.	Name of the Department- Computer Science Engineering						
2.	Course Name	Computer Fundamentals	L		T		P
3.	Course Code		3		0		0
4.	Type of Course (use tick mark)		Core (✓)		PE()		OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

Computing and programming are essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. This course has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives.

9. Learning objectives:

The main objective is to introduce IT in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive media, Internet basics, etc. At the end of this course, students should be able to

10. Course Outcomes (COs):

a) Understand basic concepts and terminology of information technology.

b) Understand the difference between an operating system and an application program, and what each is used for in a computer

c) Understand the process of algorithm development and documentation

d) Understand Basic concepts of digital electronic.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction to Computers:

Evolution of computers: Computer Generation from First Generation to Fifth Generation.
Classifications of Computers: Micro, Mini, Mainframe and super computers, Distributed Computer System, Parallel Computers.
Computer Hardware: Major Components of a digital computer, Block Diagram of a computer

Input devices, Output Device. Computer Memory: Memory Cell, Overview of Memory Organization, Primary Memory: RAM & ROM, Secondary memory, Flash Drives, Solid State Drives.

Unit – 2	Number of lectures = 10	**Introduction to System Software and Operating System**

Computer Software: Machine language, Assembly language, high-level languages, fourth generation language, assemblers, compilers, interpreters, linkers, loaders.

Operating System concepts: different types of operating systems, functions of operating system, concept of multiprogramming, multitasking, multithreading, multiprocessing, time-sharing, real time, single-user & multi-user operating system.

Unit – 3	Number of lectures = 10	**Number Systems**

Number Systems: Introduction to number systems – positional and non-positional, Base /Radix. Decimal number system-Definition, digits, radix/base, Binary number system – Bit Byte, Conversions: Binary to Decimal and Decimal to Binary. Octal number system Conversion from Octal to Decimal to Octal, Octal to Binary and binary to Octal. Hexadecimal number system –Conversion: Decimal to Hex, Hex to decimal, Hex to Binary, Binary to Hex, Octal to Hex, Hex to Octal, Binary, arithmetic –binary addition, subtraction, multiplication and division (only Integer part). 1's and 2's compliment: 2's complement subtraction.

Unit – 4	Number of lectures = 10	**Programming Concepts & Techniques:**

Algorithms, flow chart, decision tables, pseudo code, characteristics of a good programming language, Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.
Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming, Advantages and disadvantages of Structured programming.

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Online Resources:
Computer Fundamentals - Course (swayam2.ac.in)
https://onlinecourses.swayam2.ac.in/cec22_cs14/preview

13. Books Recommended

Text Books

1. P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications.

2. Anita Goel "Computer Fundamentals", Pearson.

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Programming Fundamentals**	**L**		**T**		**P**
3.	**Course Code**		**3**		**0**		**0**
4.	**Type of Course (use tick mark)**		**Core (✓)**		**PE()**		**OE ()**
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
	Lectures = 40		**Tutorials = 0**		**Practical = 0**		

8. Course Description
This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

9. Learning objectives:
   a) Understand programming basics.
   b) Understand conditional and iterative loops
   c) Explain the differences between syntax errors, runtime errors, and logic errors.
   d) To understand and apply the concept of memory addresses

10. Course Outcomes (COs):
   a) Demonstrate problem solving skills by developing and implementing algorithms to solve problems.
   b) Understand and use the fundamental concepts of data types
   c) Implement programs using functional program pedagogy
   d) Demonstrate an understanding of array, structures and pointers.

11. Unit wise detailed content

Unit-1	Number of lectures = 12	

Algorithms, flow chart, decision tables, pseudo code, characteristics of a good programming language, Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.
Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming, Advantages and disadvantages of Structured programming.

Unit – 2	Number of lectures = 10	

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- Arithmetic expressions and precedence

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

Unit – 3	Number of lectures = 12	

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function, Quick sort or Merge sort.

Unit – 4	Number of lectures = 6	

Structure**:** Structures, Defining structures and Array of Structures

Pointers: Idea of pointers

12. Brief Description of self-learning / E-learning component
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https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://onlinecourses.nptel.ac.in/noc22_cs101/preview   (Prof. Anupam Basu, IIT Kharagpur)

13. Books Recommended

Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	Web Technologies Lab	**L**		**T**		**P**
3.	**Course Code**		**0**		**0**		**2**
4.	**Type of Course (use tick mark)**		Core (✓)		PE()		OE ()
5.	**Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 28

8. Course Description

This course is an introduction to Web site development and the technologies behind it. Students will learn how to design and develop Web pages using current technologies and tools. Topics covered will include the World Wide Web, HTML, Cascading Style Sheets (CSS) and XML. The focus of this course is on dynamic HTML, a collection of web technologies such as HTML and scripting languages used together to create interactive and animated Web pages. Students will learn to program client-side scripts using JavaScript and the Document Object Model to transform static Web pages created with HTML and CSS into dynamic Web pages.

9. Learning objectives:

This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function. This will also expose students to the basic tools and applications used in Web publishing.

10. Course Outcomes (COs):

a. Create a well-designed and well-formed, professional Web site utilizing the most current standards and practices.

b. Create web pages using HTML and Cascading Style Sheets.

c. Build dynamic web pages using JavaScript (Client side programming).

d. Select appropriate Web tools for a Web development project

11. List of Experiments (Indicative)

1 Write HTML/Java scripts to display your CV in Web Browser

2 Creation and annotation of static web pages using any HTML editor.

3 Write a program to use XML and JavaScript for creation of your homepage.

4 Write a program in XML for creation of DTD which specifies a particular set of rules.

5 Create a Stylesheet in CSS/XSL and display the document in Web Browser

6 Create a Registration Form with Table

7 CSS : Inline Style , Internal Style ,and External Style Sheets

8 JavaScript & HTML:

• Use user defined function to get array of values and sort them in ascending order

 • Demonstrate String and Math Object's predefined methods

• Demonstrate Array Objects and Date Object's predefined methods

• Exception Handling

• Calendar Creation : Display all month

 • Event Handling

• Validation of registration form

• Open a Window from the current window

• Change color of background at each click of button or refresh of a page

• Display calendar for the month and year selected from combo box

•OnMouseover event

9   XML

• Create any catalog

• Display the catalog created using CSS or XS

12. Brief Description of self-learning / E-learning component
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https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	Computer Fundamentals Lab	L		T		P
3.	**Course Code**		0		0		2
4.	**Type of Course (use tick mark)**		Core (✓)		PE()		OE ()
5.	**Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
	Lectures = 0		Tutorials = 0		Practical = 28		

8. Course Description

Computing and programming are essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. This course has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives.

9. Learning objectives:

The main objective is to introduce IT in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive media, Internet basics, etc. At the end of this course, students should be able to

10. Course Outcomes (COs):

    a.   Understand basic concepts and terminology of information technology.

    b.   Understand the difference between an operating system and an application program, and what each is used for in a computer

    c.   Understand the process of algorithm development and documentation

    d.   Understand Basic concepts of digital electronic.

11. List of Experiments (Indicative)

1 MS-Windows: Operating system-Definition & functions, basics of Windows. Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance. Using windows accessories.

2 Documentation Using MS-Word - Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advance Features of MS-WordMail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

3 Electronic Spread Sheet using MS-Excel - Introduction to MS-Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation, Database Management using Excel-Sorting, Filtering, Table, Validation, Goal Seek, Scenario.

4 Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	**Name of the Department- Computer Science Engineering**					
2.	**Course Name**	**Programming Fundamentals Lab**	**L**	**T**	**P**	
3.	**Course Code**		**0**	**0**	**4**	
4.	**Type of Course (use tick mark)**		**Core (✓)**	**PE()**	**OE ()**	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem () / Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**					
	Lectures = 0		**Tutorials = 0**	**Practical = 28**		

8. Course Description

This course let you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

9. Learning objectives:
  a. Understand programming basics.
  b. Understand conditional and iterative loops
  c. Explain the differences between syntax errors, runtime errors, and logic errors.
  d. To understand and apply the concept of memory addresses

10. Course Outcomes (COs):

  a. Demonstrate problem solving skills by developing and implementing algorithms to solve problems.

  b. Understand and use the fundamental concepts of data types

  c.   Implement programs using functional program pedagogy

  d. Demonstrate an understanding of array, structures and pointers.

11. List of Experiments (Indicative)

1: Familiarization with programming environment

2: Simple computational problems using arithmetic expressions

3: Problems involving if-then-else structures

4: Iterative problems e.g., sum of series

5: 1D Array manipulation

6: Matrix problems, String operations

7: Simple functions

8 and 9: Programming for solving Numerical methods problems

10: Recursive functions

12. Basics of pointers

12. The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Semester – II

S.No	Course Code	Course Title	L	T	P	C
1		Statistics	3	1	-	4
2		Web based Programming using PHP	3	-	-	3
3		Programming in Java	3	-	-	3
4		MGE-1#	4	-	-	4
5		AECC - 2*	2	-	-	2
6		VAC – 2**	2	-	-	2
7		Web based Programming using PHP Lab	-	-	2	1
8		Programming in Java Lab	-	-	4	2
TOTAL			**17**	**1**	**6**	**21**

1.	Name of the Department- Computer Science Engineering					
2.	**Course Name**	Statistics	**L**	**T**	**P**	
3.	**Course Code**		3	1	0	
4.	**Type of Course (use tick mark)**		Core (✔)	PE()	OE ()	
5.	**Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem () / Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**					
	Lectures = 40		Tutorials = 0	Practical = 0		

8. Course Description

Statistics is a branch of mathematics that deals with the collection, analysis, interpretation, and presentation of masses of numerical data. It is a tool for prediction and forecasting based on data. It is applicable to a wide variety of academic disciplines, from the natural and social sciences to the humanities, government and business.

9. Learning objectives:

This course teaches you statistical thinking concepts that are essential for learning from data and communicating insights. By the end of the course, you will be able to perform exploratory data analysis, understand key principles of sampling, and select appropriate tests of significance for multiple contexts. You will gain the foundational skills that prepare you to pursue more advanced topics in statistical thinking and machine learning.

10. Course Outcomes (COs):

a) Summarize data in a useful and informative manner, estimate and population, characteristic based on a sample and determine if the data adequately represents the population.
b) Analyze data using measures of dispersion.
c) Apply the concepts of permutations and combinations.
d) to determine the occurrence of an event in which can be applied in any aspect of life.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	

Population, Sample and Data Condensation

Definition of statistics, Scope of statistics, Concept of population and simple with Illustration, raw data, Attributes and variables, Classification, Frequency distribution, Cumulative frequency distribution

Unit – 2	Number of lectures = 10	

Measures of Central Tendency:

Concept of central Tendency, Requirements of good measures of central tendency, Arithmetic mean, Median, Mode, Harmonic Mean, Geometric mean for grouped and ungrouped data

Measures of Dispersion

Concept of dispersion, Absolute measure of dispersion, Relative measure of dispersion, Range variance, Standard deviation, Coefficient of variation

Unit – 3	Number of lectures = 10	

Permutations and Combinations

Permutations of 'n' dissimilar objects taken 'r' at a time (with or without repetitions), $^nP_r = n!/(n-r)!$ (without proof), Combinations of 'r' objects taken from 'n' objects, $^nC_r = n!/(r!(n-r)!)$ (Without proof), Simple examples of permutations and combinations, Applications

Unit – 4	Number of lectures = 10	

Sample Space, Events and Probability

Experiments and random experiments, Ideas of deterministic and non-deterministic experiments, Definition of sample space, Discrete sample space, Events, Types of events, Union and intersections of two or more events, Mutually exclusive events, Complementary event, Exhaustive event, Simple examples, Classical definition of probability, Addition theorem of probability without Proof (up to three events are expected), Definition of conditional probability Definition of independence of two events, Simple numerical problems

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books

1. Levin, R.I. and Rubin D.S., Statistics for Management, Pearson Education.

2. Gupta, S.P. and Gupta, M.P., Business Statistics, Sultan Chand and Sons.

3. Sharma, J.K., Business Statistics, Vikas Publication House Pvt. Ltd.

4. Bajpai, Naval, Business Statistics, Pearson Education.

1.	Name of the Department- Computer Science Engineering							
2.	Course Name	Web based Programming using PHP	L		T		P	
3.	Course Code	HTML and CSS	3		0		0	
4.	Type of Course (use tick mark)		Core (✓)		PE()		OE ()	
5.	Pre-requisite (if any)		6. Frequency (use tick marks)		Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures = 40			Tutorials = 0		Practical = 0			

8. Course Description

This course aims at highlighting the features of different technologies involved in Web Development. It provides a ground-up look at web-servers, scripting languages (PHP), databases and a clear understanding on how to create web applications.

9. Learning objectives:

    a. Learn about web-servers

    b. Understanding the HTTP protocol

    c. Understand scripting fundamentals

    d. Introduction of PHP language and deployment

    e. Understanding application architectures

10. Course Outcomes (COs):

    a) Describe fundamentals of web

    b) Write simple application in PHP

    c) Applying advance features of PHP

    d) Outline the principles behind using MySQL as a backend DBMS with PHP

11. Unit wise detailed content

Unit-1	Number of lectures = 10	

Introduction to web applications: HTML, Client-Side Scripting Vs Server-Side Scripting, Web Servers: Local Servers and Remote Servers, Installing Web servers, Internet Information Server (IIS) and Personal Web Server (PWS). Static website vs Dynamic website development.

Unit – 2	Number of lectures = 10	Introduction to PHP:

Introduction to PHP: Start and End Tags of PHP, Data types in PHP, Variables, Constants, operators and Expressions, printing data on PHP page, Control statements – if, switch case, for, while, do while.

Arrays: Initialization of an array, Iterating through an array, Sorting arrays, Array Functions

Functions: Defining and Calling Functions, Passing by Value and passing by references, Inbuilt Functions.

Unit – 3	Number of lectures = 10	Working with Forms and Files

Working with Forms: Get and Post Methods, Query strings, HTML form controls and PHP

Maintaining User State: Cookies, Sessions and Application State.

Working with Files: Opening and Closing Files, Reading and Writing to Files, Getting Information on Files, OOP's – Instantiation, Modifiers, Inheritance, Interfaces, Exceptions, Static Methods and properties, Auto load, Reflection, Type Hinting and class constant.

Unit – 4	Number of lectures = 10	Database Connectivity

PHP Database Connectivity: Introduction to MYSQL, creating database and other operations on database, connecting to a database, use a particular database, sending query to database, Parsing of the query results, Checking data errors. MVC overview, security, Ajax basics, PHP with Ajax

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://onlinecourses.swayam2.ac.in/aic20_sp32/preview   (Prof Kannan Moudgalya, IIT Bombay)

13. Books Recommended

Text Books

1. Rasmus Lerdorf and Kevin Tatroe, "Programming PHP", O'Reilly.

2. Robin Nixon, "PHP, MySQL, and JavaScript: A Step-By-Step Guide to Creating Dynamic Websites", O'Reilly Media

1. Name of the Department- Computer Science Engineering						
2. Course Name	Programming in Java	L		T		P
3. Course Code		3		0		0
4. Type of Course (use tick mark)		Core (✓)		PE()		OE ()
5. Pre-requisite (if any)	Programming Fundamentals	6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 40		Tutorials = 0		Practical = 0		
8. Course Description						
This course of study builds on the skills gained by students in Java programming Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities						
9. Learning objectives:						
• This module gives students the skills and knowledge to understand java programming. • How to write Java code according to Object-Oriented Programming principles • How to design GUI applications and Applets using AWT						
10. Course Outcomes (COs):						
a) Describe Java concepts						
b) Identify various data types						
c) Evaluate various java concept using programs						
d) Event handling and input/output programming in java						
11. Unit wise detailed content						
Unit-1	Number of lectures = 10	Preliminaries				
Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping: if..else, switch,?: operator, while, do, for statements, labelled loops, jump statements: break, continue return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.						
Unit – 2	Number of lectures = 10	Arrays and Strings				
Arrays and String: Creating an array, one- and two-dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.						
Unit – 3	Number of lectures = 10	Exception Handling				

Exception Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Run able interface, inter thread Communication, suspending, resuming and stopping threads.

Unit – 4	Number of lectures = 10	I/O Programming and Event Handling

Input/output Programming: Basics Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (lang, util, io, net).

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes.

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://onlinecourses.nptel.ac.in/noc21_cs03/ (Prof. Debasis Samanta, IIT Kharagpur)
Java - Course (swayam2.ac.in)   (Prof Kannan Moudgalya, IIT Bombay)

13. Books Recommended

Text Books

1. Horstmann, "Computing Concepts with Java 2 Essentials", John Wiley.

1.	Name of the Department- Computer Science Engineering						
2.	Course Name	Web based Programming using PHP Lab	L		T		P
3.	Course Code	HTML and CSS	0		0		2
4.	Type of Course (use tick mark)		Core (✓)		PE()		OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 28

8. Course Description

This course aims at highlighting the features of different technologies involved in Web Development. It provides a ground-up look at web-servers, scripting languages (PHP), databases and a clear understanding on how to create web applications.

9. Learning objectives:

  a. Learn about web-servers

  b. Understanding the HTTP protocol

  c. Understand scripting fundamentals

  d. Introduction of PHP language and deployment

10. Course Outcomes (COs):

  a. Describe fundamentals of web

  b. Write simple application in PHP

  c. Applying advance features of PHP

  d. Outline the principles behind using MySQL as a backend DBMS with PHP

11. List of Experiments (Indicative)

  1. WAP using Client-side scripting to perform arithmetical tasks and display results.

  2. WAP in PHP to accept values from user and check the eligibility to vote, and print result on screen.

  3. WAP in PHP to display table of a given no.

  4. WAP to transfer data from one page to another using PHP. Working in forms and using get and post method.

  5. WAP to manage data and information across the pages like in shopping carts etc.

6. WAP a program to count total numbers of hit (visitor no) on the site and also total no of users online.

7. Make a page to store the data in file and reading the data from file.

8. Make an application to upload image file to website and display on site. Image to be uploaded dynamically using PHP controls etc.

9. Write SQL Commands to create database, create a table in it and store data in this table. Also write commands to search and delete the record.

10. Write PHP code to connect to database (MySQL) , and perform following operations

     a. insert new record
     b. search for record(s)
     c. change any record
     d. delete the record(s)

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Programming in Java Lab**	**L**		**T**		**P**
3.	**Course Code**	Programming Fundamentals	**0**		**0**		**4**
4.	**Type of Course (use tick mark)**		**Core (✓))**		**PE()**		**OE ()**
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						

Lectures = 0	Tutorials = 0	Practical = 28

8. Course Description

This course of study builds on the skills gained by students in Java programming Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities

9. Learning objectives:
- This module gives students the skills and knowledge to understand java programming.
- How to write Java code according to Object-Oriented Programming principles
- How to design GUI applications and Applets using AWT

10. Course Outcomes (COs):

a. Describe Java concepts

b. Identify various data types

c. Evaluate various java concept using programs

d. Event handling and input/output programming in java

11. List of Experiments (Indicative)

1. Create a java program to implement stack and queue concept.

2. Write a java package to show dynamic polymorphism and interfaces.

3. Write a java program to show multithreaded producer and consumer application.

4. Create a customized exception and also make use of all the 5 exception keywords.

5. Convert the content of a given file into the uppercase content of the same file.

6. Develop an analog clock using applet.

7. Develop a scientific calculator using swings.

8. Create an editor like MS-word using swings.

9. Create a servlet that uses Cookies to store the number of times a user has visited your servlet.

10. Create a simple java bean having bound and constrained properties.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Bachelor in Computer Applications with minor in Cloud Computing

Semester – III

S.No	Course Code	Course Title	L	T	P	C
1		Cloud Computing	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		MGE – 2#	4	-	-	4
5		AECC – 3*	2	-	-	2
6		VAC – 3**	2	-	-	2
7		Data Structure and Algorithms Lab	-	-	4	2
8		Operating Systems Lab	-	-	2	1
9		Cloud Computing Lab	-	-	2	1
10		Summer Internship-I	-	-	-	2
TOTAL			**17**	**0**	**8**	**23**

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Cloud Computing**		**L**	**T**		**P**
3.	**Course Code**			**3**	**0**		**0**
4.	**Type of Course (use tick mark)**			**Core (✓)**	**PE ()**		**OE ()**
5.	**Pre-requisite (if any)**			**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

9. Learning objectives:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

10. Course Outcomes (COs):

a.	Understand the basic terminologies, characteristics and platforms of Cloud Computing
b.	Understand the basic principles of virtualization
c.	Provide basics of cloud files systems
d.	Understand basic issues concerning cloud security

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction
Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open-Source platforms: OpenStack.		
Unit – 2	Number of lectures = 10	Virtualization, Server, Storage and Networking

Virtualization: Basic Concepts, Types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit – 3	Number of lectures = 10	Data in Cloud Computing

Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

Unit – 4	Number of lectures = 10	Cloud Security

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resource:

https://nptel.ac.in/courses/106/104/106104028/ **(Prof. Soumya Kanti Ghosh, IIT Khargpur)**

Books Recommended

Text Books

1. Enterprise Cloud Computing, Gautam Shroff, Cambridge Publication

Reference Books:

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Cloud Computing Lab**	**L**		**T**		**P**
3.	**Course Code**		**0**		**0**		**2**
4.	**Type of Course (use tick mark)**		**Core (✓)**	**PE ()**		**OE ()**	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	**Tutorials = 0**	**Practical = 24**

8. Course Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

9. Learning objectives:
1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

10. Course Outcomes (COs):

a) Create basic deployment of services on Google app engine

b) Deploy private cloud using Open Stack and Cloud Stack

c) Deploy hypervisor and install OS and applications

d) Understand various services offered by Amazon Web Services.

11. List of Experiments

1. Development of applications on Google app engine.
2. Setting up of private Cloud setup through OpenStack
3. Setting up of private Cloud setup through CloudStack
4. Installation of XEN/VMware/KVM hypervisor and Manage resource of different OS instances
5. Case study of Amazon ec2.

1.	Name of the Department- Computer Science Engineering					
2.	**Course Name**	Data Structure & Algorithms	**L**	**T**		**P**
3.	**Course Code**		**3**	**0**		**0**
4.	**Type of Course (use tick mark)**		Core (✔)	PE ()		OE ()
5.	**Pre-requisite (if any)**	Programming Fundamentals	**6.Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description
This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

9. Learning objectives:

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

10. Course Outcomes (COs):

a) Analyze the algorithms to determine the time and computation complexity and justify the correctness.
b) Implement a given Search problem (Linear Search and Binary Search).
c) Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity
d) Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

11. Unit wise detailed content

Unit-1	**Number of lectures = 8**	**Introduction to Data Structures**
Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic		

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Trade-off.

Unit – 2	Number of lectures = 12	The Stacks Queues and Lists

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities.

Unit – 3	Number of lectures = 12	Trees, Graphs

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit – 4	Number of lectures = 8	Sorting & Searching Algorithms

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

e) Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106106127.pdf;
https://nptel.ac.in/courses/106/105/106105225/

Books Recommended

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.

2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books:

3. Schaum's outline series, "Data Structure", McGraw Hills.

4. Y. Langsamet. al., "Data Structures using C and C++", PHI.

1. **Name of the Department- Computer Science Engineering**						
2. **Course Name**	**Data Structure & Algorithms Lab**	**L**		**T**		**P**
3. **Course Code**		**0**		**0**		**4**
4. **Type of Course (use tick mark)**		Core (✔)		PE ()		OE ()
5. **Pre-requisite (if any)**	Programming Fundamentals	6. **Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	**Tutorials = 0**	**Practical = 24**

8. Course Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

9. Learning objectives:

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

10. Course Outcomes (COs):

a) Analyze the algorithms to determine the time and computation complexity and justify the correctness.
b) Implement a given Search problem (Linear Search and Binary Search).
c) Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity
d) Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

11. List of Experiments

1. Write a program for multiplication and transpose of array.
2. Write a program to compute the transpose of a sparse matrix
3. Write a program to implement push and pop operation in Stack.
4. Write a program to convert an Infix notation to post fix notation using stacks
5. Write a program to evaluate postfix notation using stacks
6. Write a program to implement a linear queue
7. Write a program for swapping two numbers using call by value and call by reference strategies.

8. Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.

9. Write a program to implement a linear search arrays and linked list.

10. Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.

11. Write the programs to implement bubble sort.

12. Write a program using iteration and recursion concepts for quick sort.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106106127.pdf;
https://nptel.ac.in/courses/106/105/106105225/

13. Books Recommended

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.

2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books:

3. Schaum's outline series, "Data Structure", McGraw Hills.

4. Y. Langsamet. al., "Data Structures using C and C++", PHI.

1. **Name of the Department- Computer Science Engineering**					
2. **Course Name**	**Operating System**	**L**	**T**		**P**
3. **Course Code**		**3**	**0**		**0**
4. **Type of Course (use tick mark)**		**Core (✓)**	**PE ()**		**OE ()**
5. **Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**		
Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

9. Learning objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication.

2. To learn the mechanisms involved in memory management in contemporary OS

3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

4. To know the components and management aspects of concurrency management

5. To learn to implement simple OS mechanisms

10. Course Outcomes (COs):

a) Create processes and threads.

b) Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

c) For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

d) Design and implement file management system.

e) For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Unit wise detailed content

Unit-1	Number of lectures = 6	Introduction

Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit – 2	Number of lectures = 12	Process Management

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit – 3	Number of lectures = 12	Memory Management

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free- space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit – 4	Number of lectures = 10	Deadlocks

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resources:

https://nptel.ac.in/courses/106/105/106105214/   (Narayanaswamy N S, IIT Madras)

12. Books Recommended

Text Books

1. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books:

1.   Tannenbaum, "Operating Systems", PHI, 4th Edition.

2.   William Stallings, "Operating Systems Internals and Design Principles", PHI

3.   HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.

4.   W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

1.	Name of the Department- Computer Science Engineering				
2.	**Course Name**	**Operating System Lab**	**L**	**T**	**P**
3.	**Course Code**		**0**	**0**	**2**
4.	**Type of Course (use tick mark)**		**Core (✓)**	**PE ()**	**OE ()**

5.	**Pre-requisite (if any)**	Programming Fundamentals	6.	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	**Tutorials = 0**	**Practical = 14**

8. Course Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

9. Learning objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication.

2. To learn the mechanisms involved in memory management in contemporary OS

3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

4. To know the components and management aspects of concurrency management

5. To learn to implement simple OS mechanisms

10. Course Outcomes (COs):

a) Create processes and threads.

b) Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

c) For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

d) Design and implement file management system.

e) For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

11. List of Experiments

1. Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority

2. Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

3. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

4. Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked

5. Write a C program to simulate the MVT and MFT memory management techniques.

6. Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit

7. Write a C program to simulate paging technique of memory management

8. Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical

9. Write a C program to simulate Banker's algorithm for the purpose of deadlock avoidance.

10. Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books
1. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books:

1. Tannenbaum, "Operating Systems", PHI, 4th Edition.

2. William Stallings, "Operating Systems Internals and Design Principles", PHI

3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.

4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

1. Name of the Department- Computer Science Engineering					
2. Course Name	Summer Internship - I	L	T		P
3. Course Code		0	0		0
4. Type of Course (use tick mark)		Core (✓)	PE ()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 0

8. Course Description

This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

9. Learning objectives:

- The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

11. Course Content

The students will be evaluated based on 4 weeks of work at industry site after second semester. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review

Semester – IV

S.No	Course Code	Course Title	L	T	P	C
1		Cloud Computing Architecture and Deployment Models	3	-	-	3
2		Computer Networks	3	-	-	3
3		Database Management Systems	3	1	-	4
4		MGE - 3#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		VAC – 4**	2	-	-	2
7		Database Management Systems Lab	-	-	4	2
8		Computer Networks Lab	-	-	2	1
9		Cloud Computing Architecture and Deployment Models Lab	-	-	2	1
TOTAL			**17**	**1**	**8**	**22**

1.	Name of the Department- Computer Science Engineering				
2.	**Course Name**	Cloud Computing Architecture and Deployment Models	L	T	P
3.	**Course Code**		3	0	0
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()	OE ()
5.	**Pre-requisite (if any)**	Cloud Computing	**6. Frequency (use tick marks)**	Even (✓) / Odd ()	Either Sem () / Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

- To help the students to understand: The concept of cloud computing and describe the choices that are available to developers when creating cloud applications

- Describe infrastructure as a service, platform as a service, and software as a service

9. Learning objectives:

- Upon successful completion of the course in this discipline the student will be able creating cloud applications and deploy on cloud platform

10. Course Outcomes (COs):

At the end of the course, the student can: Earn basic knowledge of Cloud Technologies in use today:

- Strategic plan to move applications and services to the Cloud

- Understand Cloud Segments and Cloud Deployment Models

- Importance of security in cloud computing

- Static Application Development using Service models

Unit wise detailed content

Unit-1	Number of lectures = 10	OVERVIEW OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction; Overview of Cloud Computing; Cloud Service models and Cloud Deployment Models; Cloud History – Internet technologies (SOA, Web Services, Web 2.0, mashups), Distributed computing – Utility and Grid Computing, Hardware – VMWare ESXi, Xen, KVM; Virtual Appliances and the open Virtualization format; System Management; Anatomy of Cloud; Benefits of Cloud; Cloud Transformation roadmap; cloud delivery models and their advantages; Cloud computing architecture.

Unit – 2	Number of lectures = 10	INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service delivery model, characteristics of IaaS, Architecture, examples of IaaS, Applicability of IaaS in the industry, Comparing ISPs and IaaS, Motivations for renting the infrastructure; IaaS Case studies; IaaS enabling Technology; Trusted cloud, Amazon EC2.

Unit – 3	Number of lectures = 10	PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service delivery model, characteristics of PaaS, patterns, architecture and examples of PaaS, Applicability of PaaS in the industry; Integrated Lifecycle Platform; Anchored Lifecycle platform; Enabling Technologies as a Platform; PaaS – best option or not; Google App Engine

Unit – 4	Number of lectures = 10	SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service delivery model, characteristics of SaaS, SaaS Origin; Evolvement of SaaS – Salseforce.com's approach; SaaS Economics and Ecosystem; Types of SaaS Platforms; Architecture, SaaS – Providers; Collaboration as a Service; Enabling and Management tools as a Service; Applicability of SaaS in the industry.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://www.coursera.org/learn/cloud-applications-part1#syllabus   (University of Illinois at Urbana-Champaign)

12. Books Recommended

Text Books
   1. Cloud Computing: Concepts, Technology & Architecture, Zaigham Mahmood, Ricardo Puttini, Thomas Erl, O'Rilley

1. Name of the Department- Computer Science Engineering					
2. **Course Name**	**Cloud Computing Architecture and Deployment Models Lab**	**L**		**T**	**P**
3. **Course Code**	Cloud Computing	**0**		**0**	**2**
4. **Type of Course (use tick mark)**		**Core (✓)**		**PE ()**	**OE ()**
5. **Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even (✓) / Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

- To help the students to understand: The concept of cloud computing and describe the choices that are available to developers when creating cloud applications

- Describe infrastructure as a service, platform as a service, and software as a service

9. Learning objectives:

Upon successful completion of the course in this discipline the student will be able creating cloud applications and deploy on cloud platform.

10. Course Outcomes (COs):

At the end of the course, the student can: Earn basic knowledge of Cloud Technologies in use today

- Strategic plan to move applications and services to the Cloud

- Understand Cloud Segments and Cloud Deployment Models

- Importance of security in cloud computing

- Static Application Development using Service models

11. List of Experiments

1. Creating a Warehouse Application in SalesForce.com.

2. Deploy the own cloud storage server using Docker

3. Implementation of SOAP Web services in C#/JAVA Applications.

4. Case Study: PAAS (Facebook, Google App Engine)

5. Case Study: Amazon Web Services.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering				
2.	Course Name	Computer Networks	L	T	P
3.	Course Code		3	0	0
4.	Type of Course (use tick mark)		Core (✓)	PE ()	OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

   1.   Help in understanding the concepts of communication and computer networks.

10. Course Outcomes (COs):

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. Explain the functions of the different layer of the OSI Protocol.
5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

11. Unit wise detailed content

Unit-1	Number of lectures = 8	Data communication Components

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit – 2	Number of lectures = 12	Data Link Layer and Medium Access Sub Layer

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit – 3	Number of lectures = 12	Network Layer & Transport Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit – 4	Number of lectures = 8	Application Layer:

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://onlinecourses.nptel.ac.in/noc22_cs19/preview

13. Books Recommended

Text Books
   1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
   2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

1.	Name of the Department- Computer Science Engineering							
2.	**Course Name**	Computer Networks Lab	**L**		**T**		**P**	
3.	**Course Code**		**0**		**0**		**2**	
4.	**Type of Course (use tick mark)**		Core (✓)		PE ()		OE ()	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

1. Help in understanding the concepts of communication and computer networks.

10. Course Outcomes (COs):

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. Explain the functions of the different layer of the OSI Protocol.
5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.

11. List of Experiments

1. Study of Network devices in detail
2. Connect the computers in Local Area Network using packet tracer
3. Implementation of Data Link Framing method - Character Count.
4. Implementation of Error detection method - even and odd parity.
5. Implementation of Error detection method - CRC Polynomials
6. Study of Network IP Addressing using packet tracer
7. Design TCP client and server application to transfer file
8. Design UDP client and server application to transfer file
9. Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)
10. Working on NMAP Tool for Port scanning.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

1. Name of the Department- Computer Science Engineering						
2. Course Name	Database Management Systems	L		T		P
3. Course Code		3		1		0
4. Type of Course (use tick mark)		Core (✓)		PE ()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

1. To understand the different issues involved in the design and implementation of a database system.

2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models

3. To understand and use data manipulation language to query, update, and manage a database
   To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

4. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

10. Course Outcomes (COs):

1. For a given query write relational algebra expressions for that query and optimize the developed expressions

2. For a given specification of the requirement design the databases using E-R method and normalization.

3. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

4. For a given query optimize its execution using Query optimization algorithms

5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

11. Unit wise detailed content

Unit-1	Number of lectures = 8	Database system architecture & Data Models

Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit – 2	Number of lectures = 12	Relational query languages

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit – 3	Number of lectures = 12	Storage strategies

Indices, B-trees, hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit – 4	Number of lectures = 8	Database Security

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases,

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106105175.pdf;
https://nptel.ac.in/courses/106/104/106104135

13. Books Recommended

Text Books
1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F.

Korth, S. Sudarshan, McGraw-Hill

Reference Books

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

3 "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

1. Name of the Department- Computer Science Engineering					
2. Course Name	Database Management Systems Lab	L	T	P	
3. Course Code		0	0	4	
4. Type of Course (use tick mark)		Core (✓)	PE ()	OE ()	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

1. To understand the different issues involved in the design and implementation of a database system.

2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models

3. To understand and use data manipulation language to query, update, and manage a database To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

4. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

10. Course Outcomes (COs):

7. For a given query write relational algebra expressions for that query and optimize the developed expressions

8. For a given specification of the requirement design the databases using E-R method and normalization.

9. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

10. For a given query optimize its execution using Query optimization algorithms

11. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

12. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

11. List of Experiments

1. Design a Database and create required tables. For e.g. Bank, College Database

2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.

3. Write a SQL statement for implementing ALTER, UPDATE and DELETE.

4. Write the queries to implement the joins.

5. Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().

6. Write the queries to implement the concept of Integrity constrains

7. Write the queries to create the views.

8. Perform the queries for triggers.

9. Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.

10. Do some more practice based on your class work.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Semester – V

S.No	Course Code	Course Title	L	T	P	C
1		Virtualization and Cloud Security	3	-	-	3
2		Departmental Elective – I	3	-	-	3
3		Departmental Elective – II	3	-	-	3
4		Data Visualization and Story Telling	3	-	-	3
5		MGE – 4[#]	4	-	-	4
6		Virtualization and Cloud Security Lab	-	-	2	1
7		Departmental Elective -I Lab	-	-	2	1
8		Departmental Elective-II Lab	-	-	2	1
9		Data Visualization and Story Telling Lab	-	-	2	1
10		Mobile Application Development	-	-	4	2
11		Summer Internship-II	-	-	-	4
TOTAL			**16**	**0**	**12**	**26**

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Virtualization and Cloud Security**	**L**		**T**		**P**
3.	**Course Code**		**3**		**0**		**0**
4.	**Type of Course (use tick mark)**		Core (✓)		PE ()		OE ()
5.	**Pre-requisite (if any)**	Cloud Computing	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

This course provides the ground-up coverage on the high-level concepts of cloud landscape, virtualization, architectural principles, techniques, design patterns and real-world best practices applied to Cloud service providers and consumers and delivering secure Cloud based services.

9. Learning objectives:

To provide knowledge on virtualization concepts and its application in cloud computing. To understand and implement the security consideration in cloud environment.

10. Course Outcomes (COs):

The course should enable the students to:

1. Understand the basic concepts of virtualization.

2. Learn the network and application virtualization.

3. Describe the security architecture of cloud computing and security service models.

4. Analyse the Strategies for Secure Operation the cloud architecture and list the security requirements.

Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction to virtualization

Traditional IT Infrastructure, Benefits of Virtualization, History of Virtualization, Types of Virtualization: Para Virtualization, Full Virtualization and Hybrid Virtualization, SLA.

Unit – 2	Number of lectures = 10	Network and application virtualization

Types of Server Virtualization, Hypervisors, Anatomy of Server Virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, VPN, VLAN, Benefits of Application Virtualization.

Unit – 3	Number of lectures = 10	Introduction to Cloud Security

Introduction to Cloud Computing and Security: Overview of Security Architecture, Control over Security in the Cloud Model- Cloud Computing: Security Concerns- Risk Tolerance- Legal and Regulatory Issues, Security Requirements for the Architecture-Security Patterns and Architectural Elements-Cloud Security Architecture-Key Strategies for Secure Operation

Unit – 4	Number of lectures = 10	Securing the Cloud

Private Clouds: Motivation and Overview-Security Implications: Shared versus Dedicated Resources, Security Criteria for Ensuring a Private Cloud - Network Considerations- Data Centre Considerations- Operational Security Considerations, Selecting a CSP: Overview of Assurance, Overview of Risks

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://www.coursera.org/learn/introduction-to-cloud#syllabus   [IBM]
https://www.coursera.org/learn/cloud-computing-basics?#about   [LearnQuest]

12. Books Recommended

Text Books

1. Virtualization-A Beginner's Guide, Nelson Ruest (Author), Danielle Ruest , McGraw Hills

2. Practical Cloud Security, Zaigham Mahmood, Ricardo Puttini, Thomas Erl, O'Rilley

1.	Name of the Department- Computer Science Engineering					
2.	**Course Name**	Virtualization and Cloud Security Lab	**L**	**T**	**P**	
3.	**Course Code**		**0**	**0**	**2**	
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()	OE ()	
5.	**Pre-requisite (if any)**	Cloud Computing	**6. Frequency (use tick marks)**	Even () / Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	**Tutorials = 0**	**Practical = 24**

8. Course Description

- This course provides the ground-up coverage on the high-level concepts of cloud landscape, virtualization, architectural principles, techniques, design patterns and real-world best practices applied to Cloud service providers and consumers and delivering secure Cloud based services.

9. Learning objectives:

- To provide knowledge on virtualization concepts and its application in cloud computing. To understand and implement the security consideration in cloud environment.

10. Course Outcomes (COs):

The course should enable the students to:

1. Understand the basic concepts of virtualization.

2. Learn the network and application virtualization.

3. Describe the security architecture of cloud computing and security service models.

4. Analyse the Strategies for Secure Operation the cloud architecture and list the security requirements.

11. List of Experiments
1. Virtual Machine Using VMware

2. Virtual Machine Using QEMU

3. KVM on Ubuntu 12.10

4. KVM and guest operating system on CentOS6.3

5. Installation of VMware ESX Server

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Departmental Electives – I and Departmental Electives - II

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Basics of Machine Learning**	**L**	**T**		**P**	
3.	**Course Code**	Statistics	**3**	**0**		**0**	
4.	**Type of Course (use tick mark)**		**Core ()**	**PE (✔)**		**OE ()**	
5.	**Pre-requisite (if any)**	Statistics	**6. Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
	Lectures = 40			**Tutorials = 0**		**Practical = 0**	

8.	**Course Description**
	• The Machine Learning basics program is designed to offer a solid foundation & work-ready skills for machine learning engineers, data scientists, and artificial intelligence professionals.

9. Learning objectives:
• To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
• Explore supervised and unsupervised learning paradigms of machine learning.

10. Course Outcomes (COs):
• Illustrate and comprehend the basics of Machine Learning with Python
• Demonstrate the algorithms of Supervised Learning and be able to differentiate linear and logistic regressions
• Demonstrate the algorithms of Unsupervised Learning and be able to understand the clustering algorithms

Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction to Machine Learning with Python
Introduction to Machine Learning, basic terminology, Types of Machine Learning and Applications, Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination		

Unit – 2	Number of lectures = 10	Supervised Learning
Types of Supervised Learning, Supervised Machine Learning Algorithms: k-Nearest Neighbors, Regression Models, Naive Bayes Classifiers, Decision Trees.		

Unit – 3	Number of lectures = 10	Building good training datasets:

Dealing with missing data, Handling categorical data, partitioning a data set into separate training and test datasets, bringing features onto the same scale, selecting meaningful features, assessing feature importance with random forests.

Unit – 4	Number of lectures = 10	Clustering

K-Means clustering, Neural network: Perceptron, multilayer network- back propagation- introduction to deep neural network

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://onlinecourses.nptel.ac.in/noc22_cs73/preview (Prof. Balaraman Ravindran, IIT Madras)

Books Recommended

Text Books

1) Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Muller & Sarah Guido, Orielly Publications, 2019.

2) Python Machine Learning, Sebastian Raschka & Vahid Mirjalili, 3rd Edition, 2019.

3) Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 1st Edition, 2019

1. Name of the Department- Computer Science Engineering					
2. Course Name	Basics of Machine Learning Lab	L	T		P
3. Course Code		0	0		2
4. Type of Course (use tick mark)		Core ()	PE (✔)		OE ()
5. Pre-requisite (if any)	Statistics	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem () / Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

- The Machine Learning basics program is designed to offer a solid foundation & work-ready skills for machine learning engineers, data scientists, and artificial intelligence professionals.

9. Learning objectives:

- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.

10. Course Outcomes (COs):

- Illustrate and comprehend the basics of Machine Learning with Python
- Demonstrate the algorithms of Supervised Learning and be able to differentiate linear and logistic regressions
- Demonstrate the algorithms of Unsupervised Learning and be able to understand the clustering algorithms

List of Experiments

Experiment 1:
- Installation of Python and its packages (Pandas, NumPy, SciPy, matplotlib and scikit-learn)
- (Install Anaconda, Jypyter Notebook, Programs covering basic concepts in Python Programming)
- Basics of Python:
- Write a program to read two numbers from user and display the result using bitwise & , | and ^ operators on the numbers.
- Write a program to calculate the sum of numbers from 1 to 20 which are not divisible by 2, 3 or 5.
- Write a program to find the maximum of two numbers using functions.
- Implement slicing operation on strings and lists.

Experiment 2:
- Implement python program to load structured data onto DataFrame and perform exploratory data analysis
- Implement python program for data preparation activities such as filtering, grouping, ordering and
- joining of datasets.

Experiment 3:

- Implement Python program to prepare plots such as bar plot, histogram, distribution plot, box plot,
- scatter plot.

Experiment 4:
- Implement Simple Linear regression algorithm in Python
- Implement Gradient Descent algorithm for the above linear regression model

Experiment 5:
- Implement Multiple linear regression algorithm using Python.

Experiment 6:
- Implement Python Program to build logistic regression and decision tree models using the Python package statsmodel and sklearn APIs.

Experiment 7:
- Implement Python Program to perform the activities such as
  - splitting the data set into training and validation datasets
  - building model using Python package on training dataset and test on the validation dataset

Experiment 8:
- Write a Python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering					
2.	Course Name	Basics of Data Analysis	L	T		P
3.	Course Code	Statistics and Python	3	0		0
4.	Type of Course (use tick mark)		Core ()	PE (✓)		OE ()
5.	Pre-requisite (if any)	Statistics and Python	6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)					
	Lectures = 42		Tutorials = 0	Practical = 0		

8. Course Description

- This course presents a gentle introduction into the concepts of data analysis, the role of a Data Analyst, and the tools that are used to perform daily functions.

9. Learning objectives:

- To Provide the knowledge and expertise to become a proficient data scientist;

- Demonstrate an understanding of statistics and machine learning concepts that

  are vital for data science;

- Produce Python code to statistically analyze a dataset;

- Critically evaluate data visualizations based on their design and use for communicating stories

  from data;

10. Course Outcomes (COs):

1. To explain how data is collected, managed and stored for data science;

2. To understand the key concepts in data science, including their real-world

applications and the toolkit used by data scientists;

3. To implement data collection and management scripts using MongoDB.

Unit wise detailed content

Unit-1	Number of lectures = 14	Introduction

Introduction to Data Science, Different Sectors using Data science, Purpose and

Components of Python in Data Science.

Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA Quantitative technique, EDA-Graphical Technique, Data Analytics Conclusion and

Predictions.

Unit – 2	Number of lectures = 11	Feature Generation and Feature Selection (Extracting Meaning from Data)-

NumPy: Array and vectorized computation: Multidimensional array object. Creating ndarrays, arithmetic with numpy array, basic indexing and slicing, Boolean indexing, transposing array and swapping axes, universal

functions, array-oriented programming with arrays, conditional logic as arrays operations, file input and output with array.

Unit – 3	Number of lectures = 10	Data Visualization

Basic principles, Pandas: Pandas data structure, series, Data Frame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format.

Unit – 4	Number of lectures = 9	Visualization with Matplotlib

Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration.

Plotting with pandas and seaborn: line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://www.coursera.org/learn/python-data-analysis (Christopher Brooks, University of Michigan)

Books Recommended

Text Books
1. Data Sciences & Analytics, V.K. Jain, Khanna Publishing House.

2. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition.O'Reilly Media.

1. Name of the Department- Computer Science Engineering				
2. Course Name	Basics of Data Analysis Lab	L	T	P
3. Course Code		0	0	2
4. Type of Course (use tick mark)		Core ()	PE (✔)	OE ()
5. Pre-requisite (if any)	Statistics and Python	6. Frequency (use tick marks)	Even () / Odd (✔)	Either Sem () / Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

- This course presents a gentle introduction into the concepts of data analysis, the role of a Data Analyst, and the tools that are used to perform daily functions.

9. Learning objectives:

- To Provide the knowledge and expertise to become a proficient data scientist;

- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;

- Produce Python code to statistically analyze a dataset;

- Critically evaluate data visualizations based on their design and use for communicating stories from data;

10. Course Outcomes (COs):

1. To explain how data is collected, managed and stored for data science;

2. To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;

3. To implement data collection and management scripts using MongoDB.

11. List of Experiments

1. Python Environment setup and Essentials.

2. Mathematical computing with Python (NumPy).

3. Scientific Computing with Python (SciPy).

4. Data Manipulation with Pandas.

5. Prediction using Scikit-Learn

6. Data Visualization in python using matplotlib

1.	Name of the Department- Computer Science Engineering					
2.	**Course Name**	**Internet of Things**	**L**	**T**		**P**
3.	**Course Code**		**3**	**0**		**0**
4.	**Type of Course (use tick mark)**		**Core ()**	**PE (✓)**		**OE ()**
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions..

9. Learning objectives:

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

10. Course Outcomes (COs):

- a. Understand IoT and its hardware and software components
- b. Interface I/O devices, sensors and communication mobiles
- c. Remotely monitor data and control devices
- d. Develop real life IoT based projects

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit – 2	Number of lectures = 10	Network and Communication Aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit – 3	Number of lectures = 10	Challenges in IoT

Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications.

Unit – 4	Number of lectures = 10	Developing IoT's

Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resource:

https://nptel.ac.in/courses/106/104/106104028/ **(Prof. Sudip Misra, IIT Kharagpur)**

Books Recommended

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

1. Name of the Department- Computer Science Engineering							
2. Course Name	Internet of Things Lab	L		T		P	
3. Course Code		0		0		2	
4. Type of Course (use tick mark)		Core ()		PE (✓)		OE ()	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)		Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures = 0			Tutorials = 0		Practical = 20		

8. Course Description

This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

9. Learning objectives:

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects.

10. Course Outcomes (COs):

    a. Understand IoT and its hardware and software components

    b. CO2. Interface I/O, sensors and communication mobiles

    c. CO3. Remotely monitor data and control devices

    d. CO4. Develop real life IoT based projects

11. List of Experiments

1 Start Raspberry Pi and try various Linux commands in command terminal window

2 Read your name and print Hello message with name.

3 Read two numbers and print their sum, difference, product and division.

4 Word and character count of a given string

5 Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input

6 Print a name 'n' times, where name and n are read from standard input, using for and while loops.

7 Handle Divided by Zero Exception.

8 Print current time for 10 times with an interval of 10 seconds.

9 Read a file line by line and print the word count of each line.

10 To inter face LED/Buzzer with Arduino/Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.

11 Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.

1. Name of the Department- Computer Science Engineering					
2. Course Name	**Data Visualization and Story Telling**	**L**	**T**		**P**
3. Course Code		**3**	**0**		**0**
4. Type of Course (use tick mark)		Core (✓)	PE ()		OE ()
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem () / Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)					
Lectures = 40			**Tutorials = 0**		**Practical = 0**

8. Course Description

Designed to help you become a successful Data Analyst, this Subject is for those just starting their career in Analytics. It will teach you how to understand data fundamental, analyse the data methodology, techniques, powerful dashboards, Power BI & Visualization power of data along with a strong focus on case studies to ensure hands on learning. Once armed with analytics, you will also learn the powerful data visualization tool like Advanced version of Excel, Power Map, Power BI, Business Intelligence software, Tableau desktop version & other open source tools etc. to present your analysis.

9. Learning objectives:

- The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

10. Course Outcomes (COs):

On completion of this course, the students will be able to learn: -

1. Design and create data visualizations.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentations of data for effective communication.

11. Unit wise detailed content

Unit-1	Number of lectures = 9	Introduction

Descriptive Statistics, Basic of Grouping, ANOVA, Correlation, Polynomial Regression and Pipelines, R-squared and MSE for In-Sample Evaluation, Prediction and Decision Making, Grid Search, Model Refinement, Binning, Indicator variables.

Unit – 2	Number of lectures = 11	INTRODUCTION TO DATA MANIPULATION USING FUNCTION

Heat Map, Tree Map, Smart Chart, Azure Machine learning , Column Chart, Line Chart , Pie, Bar, Area, Scatter Chart, Data Series, Axes, Chart Sheet , Trend line , Error Bars, Spark lines, Combination Chart, Gauge, Thermometer Chart, Gantt Chart , Pareto Chart etc , Frequency Distribution, Pivot Chart, Slicers , Tables: Structured References, Table Styles , What-If Analysis: Data Tables| Correlation model |Regression model.

Unit – 3	Number of lectures = 10	Tableau

Tableau: Exploring the program interface, Connecting to a data source, Joining related data sources, Reading loosely structured Excel files, Creating a visualization using Show Me, Changing the order of the fields in a visualization, Changing the summary operation, Splitting text into multiple columns, Presenting data using storylines, Presenting Tableau operators and built-in functions, Creating a calculated field ,Creating a custom field using a formula, Adding a table calculation, Using a level of detail expressions

Unit – 4	Number of lectures = 10	Sorting and Filtering Tableau Data

Sorting and Filtering Tableau Data: Sorting based on a field's values, creating a wildcard filter, creating a condition filter, Creating a top filter, Adding a quick filter to a worksheet, Editing, clearing, and deleting filters

Creating Basic Charts: Creating column and stacked column charts, creating bar charts, stacked bar charts, and side-by-side bars, creating line charts and area fill charts, Creating pie charts, Creating scatter plots, Creating histograms, Creating a treemap. Creating Maps and Dashboards

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://www.coursera.org/learn/analytics-tableau#syllabus   Duke University

Books Recommended

Text Books

1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

2. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition. O'Reilly Media..

1. Name of the Department- Computer Science Engineering						
2. Course Name	Data Visualization and Story Telling Lab	L		T		P
3. Course Code		0		0		2
4. Type of Course (use tick mark)		Core (✔)		PE()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 28

8. Course Description

This course of study builds on the skills gained by students in Java programming Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities

9. Learning objectives:

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented analyst.

10. Course Outcomes (COs):

a. Design and create data visualizations.

b. Conduct exploratory data analysis using visualization.

c. Craft visual presentations of data for effective communication.

11. List of Experiments (Indicative)

1. Analysis of Data with Tableau

2. Formatting and Exporting of Graphs

3. Using the Rows and Columns Shelves

4. Understanding the Marks Card

5. Removing Outliers Using Scatterplot and Filtering and Groups

6. Analysing Data-Related over Time Using Date Hierarchies, Trend Lines, and Box Plots

7. Dognition Data Set, Description, and Analysis Plan

8. Implementation of Linear Regression

9. Visual Story Points in Tableau

10. Using Visualization Science to Influence Business Decisions

11. Storyboarding Your Presentation

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Mobile Application Development Lab**	**L**	**T**		**P**	
3.	**Course Code**		**0**	**0**		**4**	
4.	**Type of Course (use tick mark)**		**Core (✓)**	**PE ()**		**OE ()**	
5.	**Pre-requisite (if any)**	Java or Kotlin	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	**Tutorials = 0**	**Practical = 24**

8. Course Description

This course introduces students to programming technologies, design and development related to mobile applications**.**

This course complements ETCA228A. The course acquaints the students with various features of Android programming. The aim of the course is to organizing the data in variety of ways using data structures and solve the given problem efficiently. Java is primary language for developing applications.

9. Learning objectives:

- This course facilitates classroom and laboratory learning, letting students develop competence and confidence in android programming and understand the entire Android Apps Development Cycle, as well as it would also enable the students to independently create new Android Applications.

10. Course Outcomes (COs):

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

CO1. Design User Interface and develop activity for Android App.

CO2. Use Intent, Broadcast receivers and Internet services in Android App.

CO3. Design and implement Database Application and Content providers.

CO4. Use multimedia, camera and Location based services in Android App

List of Experiments

1. Getting Started with Android Development.

2. Activities and Views: Android Manifest.xml, Activity Class, Basic View Components: Layouts and Buttons

3. Navigation with Data: Working with Intent, Sharing Data between Activities, Application Class.

4. Android Resources: String Resources, Loading Strings in XML, Loading Strings in Code, the Resource Values Folder.

5. Drawables - Image Basics, Drawable Folders and Qualifiers, Dimensions, Image Padding, The ImageButton Widget

6. Lists Implementing an Android List, ListView, ListActivity, Empty Lists, ListAdapter, Sorting the Adapter, Overriding ArrayAdapter, List Interaction.

7. Dialogs, New and Old: AlertDialog, Custom Dialog, Support Library, Fragments, DialogFragment.

8. Menus: Options Menu, Modifying an Options Menu, Context Menu

9. Saving Data with Shared Preferences: Shared Preferences, Getting Started with Shared Preferences, Preference Activity

10. Saving Data with a Database: Setting Up SQLite, Creating a Helper , using the Helper, Cursor and Cursor Adapater

11. Threading with AsyncTasks: Threading in Android, AsyncTask, Tracking Progress

12. Styles and Themes: Introduction to Styling: Defining Styles, Defining Themes, Style Inheritance, Direct Theme References

13. Develop an Android based Project

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Books Recommended

Text Books

1. Data Sciences & Analytics, V.K. Jain, Khanna Publishing House.

2. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition.O'Reilly Media.

Online Resources:
Android App Development | Coursera

https://www.coursera.org/specializations/android-app-development

1.	Name of the Department- Computer Science Engineering					
2.	Course Name	Summer Internship - II	L	T		P
3.	Course Code		0	0		0
4.	Type of Course (use tick mark)		Core (✔))	PE ()		OE ()

5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 0

8. Course Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market. In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

9. Learning objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

Course Content

The student will be evaluated based on six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review

Semester VI

S.No.	Course Code	Course Title	L	T	P	C
1		Industrial Internship	-	-	-	16
TOTAL			**0**	**0**	**0**	**16**

1.	**Name of the Department- Computer Science Engineering**							
2.	**Course Name**	**Industry Internship**	**L**		**T**		**P**	
3.	**Course Code**		**0**		**0**		**0**	
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()		OE ()		
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 0

8. Course Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market. In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level.

9. Learning objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

11. Course Content

Full one semester of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review

Bachelor in Computer Application with minor in Artificial Intelligence & Machine Learning

Semester – III

S.No.	Course Code	Course Title	L	T	P	C
1		Artificial Intelligence	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		MGE – 2[#]	4	-	-	4
5		AECC – 3[*]	2	-	-	2
6		VAC – 3[**]	2	-	-	2
7		Data Structure and Algorithms Lab	-	-	4	2
8		Operating Systems Lab	-	-	2	1
9		Artificial Intelligence Lab	-	-	2	1
10		Summer Internship-I	-	-	-	2
TOTAL			**17**	**0**	**8**	**23**

1.	Name of the Department- Computer Science Engineering				
2. Course Name		Artificial Intelligence	**L**	**T**	**P**
3. Course Code			**3**	**0**	**0**
4. Type of Course (use tick mark)			Core (✓)	PE ()	OE ()

5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution. This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defence, healthcare, agriculture and many other areas.

9. Learning objectives:

1. Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
2. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
3. Formalise a given problem in the language/framework of different AI methods (e.g., as a search problem, a s a constraint satisfaction problem, as a planning problem, etc).
4. Implement basic AI algorithms (e.g., standard search or constraint propagation algorithms).
5. Design and perform an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.
6. Explain the limitations of current Artificial Intelligence techniques

10. Course Outcomes (COs):

a. Build intelligent agents for search and games
b. Solve AI problems through programming
c. Learn and apply classical and advanced techniques in field of AI
d. Describe and understand the knowledge representation and reasoning

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction
Introduction to Artificial Intelligence: Definition of AI; Turing Test; Brief History of AI. Problem Solving and Search: Problem Formulation; Search Space; States vs. Nodes; Tree Search: Breadth-First, Uniform Cost, Depth-First, Depth-Limited, Iterative Deepening; Graph Search		
Unit – 2	Number of lectures = 10	Virtualization, Server, Storage and Networking

Informed Search: Greedy Search; A* Search; Heuristic Function; Admissibility and Consistency; Deriving Heuristics via Problem Relaxation. Local Search: Hill -Climbing; Simulated Annealing; Genetic Algorithms; Local Search in Continuous Spaces.

Unit – 3	**Number of lectures = 10**	**Data in Cloud Computing**

Playing Games: Game Tree; Utility Function; Optimal Strategies; Minimax Algorithm; Alpha-Beta Pruning; Games with an Element of Chance. Beyond Classical Search: Searching with Nondeterministic Actions; Searching with Partial Observations; Online Search Agents.

Unit – 4	**Number of lectures = 10**	**Cloud Security**

Knowledge Representation and Reasoning: Ontologies, Foundations of Knowledge Representation and Reasoning, Representing and Reasoning about Objects, Relations, Events, Actions, Time, and Space; Predicate Logic, Situation Calculus, Description Logics, Reasoning with Defaults, Reasoning about Knowledge, Sample Applications.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resources:

https://nptel.ac.in/courses/106/102/106102220/;

https://onlinecourses.nptel.ac.in/noc21_cs85/preview

Books Recommended

Text Books

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, Third Edition, McGraw Hill Edition

Reference Books:

1 Russell Stuart Jonathan and Norvig Peter, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2010

1.	Name of the Department- Computer Science Engineering							
2.	**Course Name**	Artificial Intelligence Lab	**L**		**T**		**P**	
3.	**Course Code**		**0**		**0**		**2**	
4.	**Type of Course (use tick mark)**		Core (✔)		PE ()		OE ()	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✔)		Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	**Tutorials = 0**	**Practical = 24**

8. Course Description

Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution. This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defence, healthcare, agriculture and many other areas.

9. Learning objectives:

1. Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial intelligence.
2. Identify problems that are amenable to solution by AI methods, and which
AI methods may be suited to solving a given problem.
3. Formalise a given problem in the language/framework of different AI methods (e.g., as a search problem, a s a constraint satisfaction problem, as a planning problem, etc).
4. Implement basic AI algorithms (e.g., standard search or constraint propagation algorithms).
5. Design and perform an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
6. Explain the limitations of current Artificial Intelligence techniques

10. Course Outcomes (COs):

a)	Solve AI problems through programming with Python
b)	Learning optimization and inference algorithms for model learning
c)	Design and develop programs for an agent to learn and act in a structured environment
d)	Describe and understand the knowledge representation and reasoning

11.   List of Experiments (Indicative)

Write the following programs using PROLOG.

1. Write a program to solve 8-queens problem.

2. Solve any problem using depth first search.

3. Solve any problem using best first search.

4. Solve 8-puzzle problem using best first search

5. Solve Robot (traversal) problem using means End Analysis.

6. Solve traveling salesman problem.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1. Name of the Department- Computer Science Engineering					
2. Course Name	Data Structure & Algorithms	**L**	**T**		**P**
3. Course Code		**3**	**0**		**0**
4. Type of Course (use tick mark)		Core (✔)	PE ()		OE ()
5. Pre-requisite (if any)	Programming Fundamentals	**6.Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

9. Learning objectives:

5. To be able to compute the efficiency of algorithms in terms of time and space complexities.

6. To understand concepts of searching and sorting algorithms.

7. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.

8. To enable them to develop algorithms for solving problem by applying concepts of data structures.

10. Course Outcomes (COs):

f) Analyze the algorithms to determine the time and computation complexity and justify the correctness.

g) Implement a given Search problem (Linear Search and Binary Search).

h) Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity

i) Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

11. Unit wise detailed content

Unit-1	**Number of lectures = 8**	**Introduction to Data Structures**

Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Trade-off.

Unit – 2	Number of lectures = 12	The Stacks Queues and Lists

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities.

Unit – 3	Number of lectures = 12	Trees, Graphs

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit – 4	Number of lectures = 8	Sorting & Searching Algorithms

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106106127.pdf;
https://nptel.ac.in/courses/106/105/106105225/

13. **Books Recommended**

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.

2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books:

3. Schaum's outline series, "Data Structure", McGraw Hills.
4. Y. Langsamet. al., "Data Structures using C and C++", PHI.

1. Name of the Department- Computer Science Engineering						
2. **Course Name**	Data Structure & Algorithms Lab	**L**		**T**		**P**
3. **Course Code**		**0**		**0**		**4**
4. **Type of Course (use tick mark)**		Core (✓)		PE ()		OE ()
5. **Pre-requisite (if any)**	Programming Fundamentals	6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
Lectures = 0		Tutorials = 0		Practical = 24		

8. Course Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

9. Learning objectives:

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

10. Course Outcomes (COs):

a) Analyze the algorithms to determine the time and computation complexity and justify the correctness.
b) Implement a given Search problem (Linear Search and Binary Search).
c) Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity
d) Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

11. List of Experiments

1. Write a program for multiplication and transpose of array.
2. Write a program to compute the transpose of a sparse matrix
3. Write a program to implement push and pop operation in Stack.
4. Write a program to convert an Infix notation to post fix notation using stacks
5. Write a program to evaluate postfix notation using stacks
6. Write a program to implement a linear queue

7. Write a program for swapping two numbers using call by value and call by reference strategies.

8. Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.

9. Write a program to implement a linear search arrays and linked list.

10. Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.

11. Write the programs to implement bubble sort.

12. Write a program using iteration and recursion concepts for quick sort.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106106127.pdf;
https://nptel.ac.in/courses/106/105/106105225/

13. **Books Recommended**

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.

2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books:

3. Schaum's outline series, "Data Structure", McGraw Hills.

4. Y. Langsamet. al., "Data Structures using C and C++", PHI.

1. Name of the Department- Computer Science Engineering						
2. Course Name	Operating System	**L**		**T**		**P**
3. Course Code		**3**		**0**		**0**
4. Type of Course (use tick mark)		Core (✔)		PE ()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 40				Tutorials = 0	Practical = 0	

8. Course Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

9. Learning objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication.

2. To learn the mechanisms involved in memory management in contemporary OS

3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

4. To know the components and management aspects of concurrency management

5. To learn to implement simple OS mechanisms

10. Course Outcomes (COs):

a) Create processes and threads.

b) Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

c) For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

d) Design and implement file management system.

e) For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

11. Unit wise detailed content

Unit-1	Number of lectures = 6	Introduction
Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.		
Unit – 2	Number of lectures = 12	Process Management

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit – 3	Number of lectures = 12	Memory Management

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free- space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit – 4	Number of lectures = 10	Deadlocks

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resources:

https://nptel.ac.in/courses/106/105/106105214/   (Narayanaswamy N S, IIT Madras)

13. Books Recommended

Text Books

2. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books:

1.   Tannenbaum, "Operating Systems", PHI, 4th Edition.

2.   William Stallings, "Operating Systems Internals and Design Principles", PHI

3.   HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.

4.   W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

1. Name of the Department- Computer Science Engineering							
2. **Course Name**	**Operating System Lab**	**L**		**T**		**P**	
3. **Course Code**		**0**		**0**		**2**	
4. **Type of Course (use tick mark)**		**Core (✓)**		**PE ()**		**OE ()**	
5. **Pre-requisite (if any)**	Programming Fundamentals	6. **Frequency (use tick marks)**		Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**							
Lectures = 0			**Tutorials = 0**		**Practical = 14**		

8. Course Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

9. Learning objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication.

2. To learn the mechanisms involved in memory management in contemporary OS

3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

4. To know the components and management aspects of concurrency management

5. To learn to implement simple OS mechanisms

10. Course Outcomes (COs):

   a) Create processes and threads.

   b) Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

   c) For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

   d) Design and implement file management system.

   e) For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

11. List of Experiments

11. Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority

12. Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

13. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

14. Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked

15. Write a C program to simulate the MVT and MFT memory management techniques.

16. Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit

17. Write a C program to simulate paging technique of memory management

18. Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical

19. Write a C program to simulate Banker's algorithm for the purpose of deadlock avoidance.

20. Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books
2. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books:

1. Tannenbaum, "Operating Systems", PHI, 4th Edition.

2. William Stallings, "Operating Systems Internals and Design Principles", PHI

3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.

4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

1. Name of the Department- Computer Science Engineering					
2. Course Name	Summer Internship - I	**L**	**T**	**P**	
3. Course Code		**0**	**0**	**0**	
4. Type of Course (use tick mark)		Core (✓)	PE ()	OE ()	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 0

8. Course Description

This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

9. Learning objectives:

- The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

11. Course Content

The students will be evaluated based on 4 weeks of work at industry site after second semester. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review

Semester – IV

S.No	Course Code	Course Title	L	T	P	C
1		Foundation of Machine Learning	3	-	-	3
2		Computer Networks	3	-	-	3
3		Database Management Systems	3	1	-	4
4		MGE - 3#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		VAC – 4**	2	-	-	2
7		Database Management Systems Lab	-	-	4	2
8		Computer Networks Lab	-	-	2	1
9		Foundation of Machine Learning Lab	-	-	2	1
TOTAL			**17**	**1**	**8**	**22**

1. Name of the Department- Computer Science Engineering				
2. **Course Name**	**Foundation of Machine Learning**	**L**	**T**	**P**
3. **Course Code**		**3**	**0**	**0**
4. **Type of Course (use tick mark)**		Core (✓)	PE ()	OE ()

5. **Pre-requisite (if any)**	Statistics	6. **Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description

Machine Learning is the study of how to build computer systems that learn from experience. It is a subfield of Artificial Intelligence and intersects with statistics, cognitive science, information theory, and probability theory, among others. The course will explain how to build systems that learn and adapt using examples from real-world applications.

9. Learning objectives:

The objective of this course is to impart necessary knowledge of the foundations needed for Machine Learning and develop programming skills required to build machine learning.

10. Course Outcomes (COs):

1. Differentiate between supervised, unsupervised machine learning approaches
2. Understand and Apply Linear Regression
3. Understand and Apply Logistic Regression
4. Understand the underlying mathematical of Neural Networks

Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

Software's for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using Available Tool such as Python.

Unit – 2	Number of lectures = 10	Linear Regression

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one Variable, Linear Regression with Multiple Variables, Polynomial Regression, Feature Scaling/Selection

Unit – 3	Number of lectures = 10	Logistic Regression

Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one Variable and with Multiple Variables. The problem of Overfitting, Bias/Variance.

Unit – 4	Number of lectures = 10	Neural Networks

Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptron, Multiclass Representation, Back Propagation Algorithm.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resources:

http://onlinecourses.nptel.ac.in/noc20_cs29/preview   (Prof. Balaraman Ravindran, II Madras)

Books Recommended

Text Books

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

1.	**Name of the Department- Computer Science Engineering**						
2.	**Course Name**	Foundation of Machine Learning Lab	**L**		**T**		**P**
3.	**Course Code**		**0**		**0**		**2**
4.	**Type of Course (use tick mark)**		Core (✓))		PE ()		OE ()
5.	**Pre-requisite (if any)**	Statistics and Python	6. **Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**		
Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

Machine Learning is the study of how to build computer systems that learn from experience. It is a subfield of Artificial Intelligence and intersects with statistics, cognitive science, information theory, and probability theory, among others. The course will explain how to build systems that learn and adapt using examples from real-world applications.

9. Learning objectives:

The objective of this course is to impart necessary knowledge of the foundations needed for Machine Learning and develop programming skills required to build machine learning.

10. Course Outcomes (COs):

1. Ability to choose appropriate machine learning algorithm for solving a problem
2. Design and adapt existing machine learning algorithms to suit applications
3. Understand the underlying mathematical relationships across various machine learning algorithms
4. Design and implement machine learning algorithms to real world applications

11. List of Experiments (Indicative)

1. Write a programme in Python to predict the class of the flower based on available attributes.
2. Write a programme in Python to predict if a loan will get approved or not.
3. Write a programme in Python to predict the traffic on a new mode of transport.
4. Write a programme in Python to predict the class of user.
5. Write a programme in Python to identify the tweets which are hate tweets and which are not.
6. Write a programme in Python to predict the age of the actors.

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	Computer Networks	**L**	**T**		**P**	
3.	**Course Code**		**3**	**0**		**0**	
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()		OE ()	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
	Lectures = 40			**Tutorials = 0**		**Practical = 0**	
8.	**Course Description**						

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

1. Help in understanding the concepts of communication and computer networks.

10. Course Outcomes (COs):

6. To develop an understanding of modern network architectures from a design and performance perspective.
7. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
8. To provide an opportunity to do network programming
9. Explain the functions of the different layer of the OSI Protocol.
10. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

11. Unit wise detailed content

Unit-1	Number of lectures = 8	Data communication Components

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit – 2	Number of lectures = 12	Data Link Layer and Medium Access Sub Layer

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit – 3	Number of lectures = 12	Network Layer & Transport Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit – 4	Number of lectures = 8	Application Layer:

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://onlinecourses.nptel.ac.in/noc22_cs19/preview

13. Books Recommended

Text Books
3. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
4. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

1. Name of the Department- Computer Science Engineering					
2. Course Name	Computer Networks Lab	L	T		P
3. Course Code		0	0		2
4. Type of Course (use tick mark)		Core (✔)	PE ()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

1. Help in understanding the concepts of communication and computer networks.

10. Course Outcomes (COs):

6. To develop an understanding of modern network architectures from a design and performance perspective.
7. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
8. To provide an opportunity to do network programming
9. Explain the functions of the different layer of the OSI Protocol.
10. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.

11. List of Experiments

1. Study of Network devices in detail
2. Connect the computers in Local Area Network using packet tracer
3. Implementation of Data Link Framing method - Character Count.
4. Implementation of Error detection method - even and odd parity.
5. Implementation of Error detection method - CRC Polynomials
6. Study of Network IP Addressing using packet tracer
7. Design TCP client and server application to transfer file
8. Design UDP client and server application to transfer file
9. Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)
10. Working on NMAP Tool for Port scanning.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.
The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	Database Management Systems	**L**	**T**		**P**	
3.	**Course Code**		**3**	**1**		**0**	
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()		OE ()	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

5. To understand the different issues involved in the design and implementation of a database system.

6. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models

7. To understand and use data manipulation language to query, update, and manage a database
To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

8. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

10. Course Outcomes (COs):

13. For a given query write relational algebra expressions for that query and optimize the developed expressions

14. For a given specification of the requirement design the databases using E-R method and normalization.

15. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

16. For a given query optimize its execution using Query optimization algorithms

17. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

18. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

11. Unit wise detailed content

Unit-1	Number of lectures = 8	Database system architecture & Data Models

Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit – 2	Number of lectures = 12	Relational query languages

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit – 3	Number of lectures = 12	Storage strategies

Indices, B-trees, hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit – 4	Number of lectures = 8	Database Security

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases,

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://nptel.ac.in/content/syllabus_pdf/106105175.pdf;
https://nptel.ac.in/courses/106/104/106104135

13. Books Recommended

Text Books
2. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F.

Korth, S. Sudarshan, McGraw-Hill

Reference Books

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

3 "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

1.	Name of the Department- Computer Science Engineering							
2.	Course Name	Database Management Systems Lab	**L**		**T**		**P**	
3.	Course Code		**0**		**0**		**4**	
4.	Type of Course (use tick mark)		Core (✓)		PE ()		OE ()	
	5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()	
7.	Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
	Lectures = 0				Tutorials = 0	Practical = 24		

8. Course Description

Through this subject, student will be able to understand the coarse-grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

9. Learning objectives:

5. To understand the different issues involved in the design and implementation of a database system.

6. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models

7. To understand and use data manipulation language to query, update, and manage a database To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

8. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

10. Course Outcomes (COs):

1. For a given query write relational algebra expressions for that query and optimize the developed expressions

2. For a given specification of the requirement design the databases using E-R method and normalization.

3. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

4. For a given query optimize its execution using Query optimization algorithms

5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

11. List of Experiments

11. Design a Database and create required tables. For e.g. Bank, College Database

12. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.

13. Write a SQL statement for implementing ALTER, UPDATE and DELETE.

14. Write the queries to implement the joins.

15. Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().

16. Write the queries to implement the concept of Integrity constrains

17. Write the queries to create the views.

18. Perform the queries for triggers.

19. Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.

20. Do some more practice based on your class work.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Semester – V

S.No	Course Code	Course Title	L	T	P	C
1		R Programming for Data Analytics	3	-	-	3
2		Departmental Elective – I	3	-	-	3
3		Departmental Elective – II	3	-	-	3
4		Data Visualization and Story Telling	3	-	-	3
5		MGE – 4#	4	-	-	4
6		R Programming for Data Analytics Lab	-	-	2	1
7		Departmental Elective -I Lab	-	-	2	1
8		Departmental Elective-II Lab	-	-	2	1
9		Data Visualization and Story Telling Lab	-	-	2	1
10		Mobile Application Development	-	-	4	2
11		Summer Internship-II	-	-	-	4
TOTAL			**16**	**0**	**12**	**26**

1.	Name of the Department- Computer Science Engineering				
2.	Course Name	R Programming for Data Analytics	**L**	**T**	**P**
3.	Course Code		**3**	**0**	**0**
4.	Type of Course (use tick mark)		Core (✓)	PE ()	OE ()

5. Pre-requisite (if any)	Statistics	6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

The course begins with the study of R Programming. R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

9. Learning objectives:

To understand and implement the R programming for solving problems concerning data science.

10. Course Outcomes (COs):

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

   a. Machine Learning Operations.

   b. Exemplary support for data wrangling.

   c. Quality plotting and graphing.

   d. The array of packages, Statistics.

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Getting Started with R and R Workspace

Introducing R, R as a programming Language, the need of R, Installing R, RStudio, RStudio's user interface, console, editor, environment pane, history pane, file pane, plots pane, package pane, help and viewer pane, R Workspace, R's working directory, R Project in R Studio, absolute and relative path, Inspecting an Environment, Inspect existing Symbols, View the structure of object, Removing symbols, Modifying Global Options, Modifying warning level, Library of Packages, Getting to know a package, Installing a Package from CRAN, Updating Package from CRAN, Installing package from online repository, Package Function, Masking and name conflicts

Unit – 2	Number of lectures = 10	Basic Objects and Basic Expressions

Vectors, Numeric Vectors, Logical Vectors, Character Vectors, subset vectors, Named Vectors, extracting element, converting vector, Arithmetic operators, create Matrix, Naming row and columns, subsetting matrix, matrix operators, creating and subsetting an Array, Creating a List, extracting element from list, subsetting a list, setting value, creating a value of data frame, subsetting a data frame, setting values,

factors, useful functions of a data frame, loading and writing data on disk, creating a function, calling a function, dynamic typing, generalizing a function. Assignment Operators, Conditional Expression, using if as expression and statement, using if with vectors, vectorized if: ifelse, using switch, using for loop, nested for loop, while loop

Unit – 3	Number of lectures = 10	Working with Basic Objects and Strings

Working with object function, getting data dimensions, reshaping data structures, iterating over one dimension, logical operators, logical functions, dealing with missing values, logical coercion, math function, number rounding functions, trigonometric functions, hyperbolic functions, extreme functions, finding roots, derivatives and integration, Statistical function, sampling from a vector, Working with random distributions, computing summary statistics, covariance and correlation matrix, printing string, concatenating string, transforming text, Formatting text, formatting date and time, formatting date and time to string, finding string pattern, using group to extract data, reading data.

Unit – 4	Number of lectures = 10	Working with Data

Visualize and Analyze Data: Reading and Writing Data, importing data using built-in-function, READR package, export a data frame to file, reading and writing Excel worksheets, reading and writing native data files, loading built-in data sets, create scatter plot, bar chart, pie chart, histogram and density plots, box plot, fitting linear model and regression tree.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resources:
https://www.coursera.org/specializations/data-science-foundations-r   (Johns Hopkins University)

13. Books Recommended
1. R for Data Science, Garrett Grolemund, Hadley Wickham, O'Reilly Media

1. Name of the Department- Computer Science Engineering					
2. **Course Name**	**R Programming for Data Analytics Lab**	**L**	**T**	**P**	
3. **Course Code**		**0**	**0**	**2**	
4. **Type of Course (use tick mark)**		Core (✔))	PE ()	OE ()	
5. **Pre-requisite (if any)**	Statistics and Programming Fundamentals	6. **Frequency (use tick marks)**	Even () / Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

The course begins with the study of R Programming. R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

9. Learning objectives:

To understand and implement the R programming for solving problems concerning data science.

10. Course Outcomes (COs):

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

     a. Machine Learning Operations.

     b. Exemplary support for data wrangling.

     c. Quality plotting and graphing.

     d. The array of packages, Statistics.

11. List of Experiments
1. Study of basic Syntaxes in R
2. Implementation of vector data objects operations
3. Implementation of matrix, array and factors and perform va in R
4. Implementation and use of data frames in R
5. Create Sample (Dummy) Data in R and perform data manipulation with R
6. Study and implementation of various control structures in R
7. Data Manipulation with dplyr package
8. Data Manipulation with data.table package
9. Study and implementation of Data Visualization with ggplot2
10. Study and implementation data transpose operations in R

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Departmental Electives – I and Departmental Electives - II

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Data Mining**	**L**		**T**		**P**
3.	**Course Code**		3		0		0
4.	**Type of Course (use tick mark)**		**Core ()**	**PE (✔)**		**OE ()**	
5.	**Pre-requisite (if any)**	Statistics	**6. Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**		
	Lectures = 40	**Tutorials = 0**	**Practical = 0**

8. Course Description

- This course presents a gentle introduction into the concepts of data mining and the tools that are used to perform daily functions.

9. Learning objectives:
1. To learn Data mining methods and its importance.
2. To learn about Business Intelligent and Decision Support system
3. To apply Data mining

10. Course Outcomes (COs):

1. Demonstrate advanced knowledge of data mining concepts and techniques.
2. Apply the techniques of clustering, classification, association finding, feature selection and visualisation on real world data
3. Determine whether a real-world problem has a data mining solution
4. Apply data mining software and toolkits in a range of applications

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction

Introduction to Data Mining, Understanding Data, Relations to Database, Statistics, Machine Learning

Unit – 2	Number of lectures = 10	Association Rules

Association Rule Mining, Level-wise Method, FP-Tree Method

Unit – 3	Number of lectures = 10	Classification

Classification, Decision Tree Algorithm, CART, Pruning Classification Tree and mapping, scoring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format.

Unit – 4	Number of lectures = 9	Clustering

Clustering Techniques, Clustering of Numeric Data, of Ordinal Data, Efficiency of Clustering, Consensus Clustering, Spectral Clustering, ROC Analysis

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://swayam.gov.in/explorer?searchText=Data+Mining   **(Prof. Gaurav Dixit, IIT Roorkee)**

13. **Books Recommended**
Text Books 1.   Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

1.	Name of the Department- Computer Science Engineering					
2.	Course Name	Data Mining Lab	L	T		P
3.	Course Code		0	0		2
4.	Type of Course (use tick mark)		Core ()	PE (✔)		OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7.	Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0		Tutorials = 0	Practical = 24

8. Course Description

This course presents a gentle introduction into the concepts of data mining and the tools that are used to perform daily functions.

9. Learning objectives:

1. To learn Data mining methods and its importance.
2. To learn about Business Intelligent and Decision Support system
3. To apply Data mining

10. Course Outcomes (COs):

1. Find the unseen pattern in large volume of historical data that helps to manage an organization efficiently.
2. Understand the concepts of various data mining Techniques.
3. Understand the concepts of Pre-processing.
4. Create user friendly reporting environment.

List of Experiments

1. 1. To list all the categorical (or nominal) attributes and the real-valued attributes separately
2. To convert a text file to ARFF (Attribute-Relation File Format) using Weka3.8.2
3. To convert ARFF (Attribute-Relation File Format) into text file.
4. To apply the concept of Linear Regression for training the given dataset.
5. To apply the Naïve Bayes Classification for testing the given dataset.
6. To develop training and testing data using numerical data set in order to get accurate model for classification.
7. To perform the data pre-processing by applying filter.
8. To apply the web mining technique clustering algorithm for the given dataset.
9. To find association between data and to find the frequent item set for text mining

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering						
2.	**Course Name**	**Cloud Computing**	**L**		**T**		**P**
3.	**Course Code**		**3**		**0**		**0**
4.	**Type of Course (use tick mark)**		Core ()	PE (✔)		OE ()	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 40		Tutorials = 0	Practical = 0

8. Course Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

9. Learning objectives:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

10. Course Outcomes (COs):

a.	Understand the basic terminologies, characteristics and platforms of Cloud Computing
b.	Understand the basic principles of virtualization
c.	Provide basics of cloud files systems
d.	Understand basic issues concerning cloud security

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction

Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open-Source platforms: OpenStack.

Unit – 2	Number of lectures = 10	Virtualization, Server, Storage and Networking

Virtualization: Basic Concepts, Types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit – 3	Number of lectures = 10	Data in Cloud Computing

Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

Unit – 4	Number of lectures = 10	Cloud Security

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

12. Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://nptel.ac.in/courses/106/104/106104028/ **(Prof. Soumya Kanti Ghosh, IIT Khargpur)**

13. Books Recommended

Text Books

1. Enterprise Cloud Computing, Gautam Shroff, Cambridge Publication

Reference Books:

1.. Handbook of Cloud Computing, Borko Furht, Springer

2. Cloud Security, Ronald Krutz and Russell Dean Vines, Wiley- India

1. **Name of the Department- Computer Science Engineering**				
2. **Course Name**	**Cloud Computing Lab**	**L**	**T**	**P**
3. **Course Code**		**0**	**0**	**2**
4. **Type of Course (use tick mark)**	**Core ()**	**PE (✓)**	**OE ()**	
5. **Pre-requisite (if any)**		**6.** **Frequency (use tick marks)**	Even () Odd (✓)	Either Sem () Every Sem ()
7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**				
Lectures = 0		**Tutorials = 0**	**Practical = 24**	

8. Course Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

9. Learning objectives:
1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

10. Course Outcomes (COs):
   a. Create basic deployment of services on Google app engine
   b. Deploy private cloud using Open Stack and Cloud Stack
   c. Deploy hypervisor and install OS and applications
   d. Understand various services offered by Amazon Web Services.

11. List of Experiments

Lab 1. Development of applications on Google app engine.

Lab 2. Setting up of private Cloud setup through OpenStack

Lab 3. Setting up of private Cloud setup through CloudStack

Lab 4. Installation of XEN/VMware/KVM hypervisor and Manage resource of different OS instances

Lab 5. Case study of Amazon ec2.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering					
2.	Course Name	Internet of Things	L	T		P
3.	Course Code		3	0		0
4.	Type of Course (use tick mark)		Core ()	PE (✓)		OE ()
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 40	Tutorials = 0	Practical = 0

8. Course Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions..

9. Learning objectives:

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

10. Course Outcomes (COs):
- e. Understand IoT and its hardware and software components
- f. Interface I/O devices, sensors and communication mobiles
- g. Remotely monitor data and control devices
- h. Develop real life IoT based projects

11. Unit wise detailed content

Unit-1	Number of lectures = 10	Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit – 2	Number of lectures = 10	Network and Communication Aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit – 3	Number of lectures = 10	Challenges in IoT

Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications.

Unit – 4	Number of lectures = 10	Developing IoT's

Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Online Resource:

https://nptel.ac.in/courses/106/104/106104028/   **(Prof. Sudip Misra, IIT Kharagpur)**

13. Books Recommended

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

1. Name of the Department- Computer Science Engineering				
2. Course Name	Internet of Things Lab	L	T	P
3. Course Code		0	0	2
4. Type of Course (use tick mark)		Core ()	PE (✔)	OE ()

5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 20

8. Course Description

This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

9. Learning objectives:

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects.

10. Course Outcomes (COs):

- e. Understand IoT and its hardware and software components
- f. CO2. Interface I/O, sensors and communication mobiles
- g. CO3. Remotely monitor data and control devices
- h. CO4. Develop real life IoT based projects

11. List of Experiments

1 Start Raspberry Pi and try various Linux commands in command terminal window

2 Read your name and print Hello message with name.

3 Read two numbers and print their sum, difference, product and division.

4 Word and character count of a given string

5 Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input

6 Print a name 'n' time, where name and n are read from standard input, using for and while loops.

7 Handle Divided by Zero Exception.

8 Print current time for 10 times with an interval of 10 seconds.

9 Read a file line by line and print the word count of each line.

10 To inter face LED/Buzzer with Arduino/Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.

11 Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.

1. **Name of the Department- Computer Science Engineering**						
2. **Course Name**	**Data Visualization and Story Telling**	**L**		**T**		**P**
3. **Course Code**		**3**		**0**		**0**
4. **Type of Course (use tick mark)**		**Core (✓)**		**PE ()**		**OE ()**
5. **Pre-requisite (if any)**		6. **Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. **Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
Lectures = 40			**Tutorials = 0**	**Practical = 0**		

8. Course Description

Designed to help you become a successful Data Analyst, this Subject is for those just starting their career in Analytics. It will teach you how to understand data fundamental, analyse the data methodology, techniques, powerful dashboards, Power BI & Visualization power of data along with a strong focus on case studies to ensure hands on learning. Once armed with analytics, you will also learn the powerful data visualization tool like Advanced version of Excel, Power Map, Power BI, Business Intelligence software, Tableau desktop version & other open source tools etc. to present your analysis.

9. Learning objectives:

- The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

10. Course Outcomes (COs):

On completion of this course, the students will be able to learn: -

4. Design and create data visualizations.

5. Conduct exploratory data analysis using visualization.

6. Craft visual presentations of data for effective communication.

11. Unit wise detailed content

Unit-1	Number of lectures = 9	Introduction

Descriptive Statistics, Basic of Grouping, ANOVA, Correlation, Polynomial Regression and Pipelines, R-squared and MSE for In-Sample Evaluation, Prediction and Decision Making, Grid Search, Model Refinement, Binning, Indicator variables.

Unit – 2	Number of lectures = 11	INTRODUCTION TO DATA MANIPULATION USING FUNCTION

Heat Map, Tree Map, Smart Chart, Azure Machine learning , Column Chart, Line Chart , Pie, Bar, Area, Scatter Chart, Data Series, Axes, Chart Sheet , Trend line , Error Bars, Spark lines, Combination Chart, Gauge, Thermometer

Chart, Gantt Chart , Pareto Chart etc , Frequency Distribution, Pivot Chart, Slicers , Tables: Structured References, Table Styles , What-If Analysis: Data Tables| Correlation model |Regression model.

Unit – 3	Number of lectures = 10	**Tableau**

Tableau: Exploring the program interface, Connecting to a data source, Joining related data sources, Reading loosely structured Excel files, Creating a visualization using Show Me, Changing the order of the fields in a visualization, Changing the summary operation, Splitting text into multiple columns, Presenting data using storylines, Presenting Tableau operators and built-in functions, Creating a calculated field ,Creating a custom field using a formula, Adding a table calculation, Using a level of detail expressions

Unit – 4	Number of lectures = 10	**Sorting and Filtering Tableau Data**

Sorting and Filtering Tableau Data: Sorting based on a field's values, creating a wildcard filter, creating a condition filter, Creating a top filter, Adding a quick filter to a worksheet, Editing, clearing, and deleting filters

Creating Basic Charts: Creating column and stacked column charts, creating bar charts, stacked bar charts, and side-by-side bars, creating line charts and area fill charts, Creating pie charts, Creating scatter plots, Creating histograms, Creating a treemap. Creating Maps and Dashboards

12.Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/
Online Resource:
https://www.coursera.org/learn/analytics-tableau#syllabus   Duke University

13.Books Recommended

Text Books
   1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

   2. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition. O'Reilly Media..

1. Name of the Department- Computer Science Engineering						
2. Course Name	Data Visualization and Story Telling Lab	L		T		P
3. Course Code		0		0		2
4. Type of Course (use tick mark)		Core (✔))		PE()		OE ()
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		Tutorials = 0		Practical = 28		

8. Course Description

This course of study builds on the skills gained by students in Java programming Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities

9. Learning objectives:

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented analyst.

10. Course Outcomes (COs):

d. Design and create data visualizations.

e. Conduct exploratory data analysis using visualization.

f. Craft visual presentations of data for effective communication.

11. List of Experiments (Indicative)

1. Analysis of Data with Tableau

2. Formatting and Exporting of Graphs

3. Using the Rows and Columns Shelves

4. Understanding the Marks Card

5. Removing Outliers Using Scatterplot and Filtering and Groups

6. Analysing Data-Related over Time Using Date Hierarchies, Trend Lines, and Box Plots

7. Dognition Data Set, Description, and Analysis Plan

8. Implementation of Linear Regression

9. Visual Story Points in Tableau

10. Using Visualization Science to Influence Business Decisions

11. Storyboarding Your Presentation

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

1.	Name of the Department- Computer Science Engineering							
2.	Course Name	Mobile Application Development Lab	L		T		P	
3.	Course Code		0		0		4	
4.	Type of Course (use tick mark)		Core (✔)		PE ()		OE ()	
5.	Pre-requisite (if any)	Java or Kotlin	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()	

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 0	Tutorials = 0	Practical = 24

8. Course Description

    This course introduces students to programming technologies, design and development related to mobile applications**.**

This course complements ETCA228A. The course acquaints the students with various features of Android programming. The aim of the course is to organizing the data in variety of ways using data structures and solve the given problem efficiently. Java is primary language for developing applications.

9. Learning objectives:

- This course facilitates classroom and laboratory learning, letting students develop competence and confidence in android programming and understand the entire Android Apps Development Cycle, as well as it would also enable the students to independently create new Android Applications.

10. Course Outcomes (COs):

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

CO1. Design User Interface and develop activity for Android App.

CO2. Use Intent, Broadcast receivers and Internet services in Android App.

CO3. Design and implement Database Application and Content providers.

CO4. Use multimedia, camera and Location based services in Android App

11. List of Experiments
1. Getting Started with Android Development.

2. Activities and Views: Android Manifest.xml, Activity Class, Basic View Components: Layouts and Buttons

3. Navigation with Data: Working with Intent, Sharing Data between Activities, Application Class.

4. Android Resources: String Resources, Loading Strings in XML, Loading Strings in Code, the Resource Values Folder.

5. Drawables - Image Basics, Drawable Folders and Qualifiers, Dimensions, Image Padding, The ImageButton Widget

6. Lists Implementing an Android List, ListView, ListActivity, Empty Lists, ListAdapter, Sorting the Adapter, Overriding ArrayAdapter, List Interaction.

7. Dialogs, New and Old: AlertDialog, Custom Dialog, Support Library, Fragments, DialogFragment.

8. Menus: Options Menu, Modifying an Options Menu, Context Menu

9. Saving Data with Shared Preferences: Shared Preferences, Getting Started with Shared Preferences, Preference Activity

10. Saving Data with a Database: Setting Up SQLite, Creating a Helper , using the Helper, Cursor and Cursor Adapater

11. Threading with AsyncTasks: Threading in Android, AsyncTask, Tracking Progress

12. Styles and Themes: Introduction to Styling: Defining Styles, Defining Themes, Style Inheritance, Direct Theme References

13. Develop an Android based Project

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal.
https://elearning.sgtuniversity.ac.in/course-category/

Books Recommended

Text Books

1. Data Sciences & Analytics, V.K. Jain, Khanna Publishing House.

2. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition.O'Reilly Media.

Online Resources:
Android App Development | Coursera

https://www.coursera.org/specializations/android-app-development

1.	**Name of the Department- Computer Science Engineering**						
2.	**Course Name**	**Summer Internship - II**	**L**		**T**		**P**
3.	**Course Code**		**0**		**0**		**0**
4.	**Type of Course (use tick mark)**		**Core (✓)**	**PE ()**		**OE ()**	
5.	**Pre-requisite (if any)**		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**						
	Lectures = 0			**Tutorials = 0**	**Practical = 0**		

8. Course Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market. In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

9. Learning objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

Course Content

The student will be evaluated based on six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review

Semester VI

S.No.	Course Code	Course Title	L	T	P	C
1		Industrial Internship	-	-	-	16
TOTAL			**0**	**0**	**0**	**16**

1.	**Name of the Department- Computer Science Engineering**						
2.	**Course Name**	**Industry Internship**	**L**		**T**		**P**
3.	**Course Code**		**0**		**0**		**0**
4.	**Type of Course (use tick mark)**		Core (✓)	PE ()		OE ()	

5.	**Pre-requisite (if any)**		6.	**Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()

7.	**Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)**		
	Lectures = 0	**Tutorials = 0**	**Practical = 0**

8. Course Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market. In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level.

9. Learning objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

10. Course Outcomes (COs):

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

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

11. Course Content

Full one semester of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review