SGT University, Chandu-Budhera, Gurugram

Faculty of Engineering & Technology

Department of Computer Science &Engineering

B. Tech. Computer Science & Engineering

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 B.Tech. (CSE) program for all semesters is given in the following pages. These are arranged as semester-wise.

Four Year B.Tech. (CSE) course at glance

	Semester I	**Semester II**	**Semester III**	**Semester IV**	**Semester V**	**Semester VI**	**Semester VII**	**Semester VIII**	**Total**
Course	10	7	10	8	9	8	6	1	59
Credit	22	15	23	23	22	22	18	16	161

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		Engineering Mathematics-I	3	1	-	4
2		Web Development	3	-	-	3
3		Basics of Electrical & Electronics Engineering	3	-	-	3
4		Programming for Problem Solving	3	-	-	3
5		AECC -1*	2	-	-	2
6		VAC – 1**	2	-	-	2
7		Programming for Problem Solving Lab	-	-	4	2
8		Web Development Lab	-	-	2	1
9		Python Programming Lab	-	-	2	1
10		Basics of Electrical & Electronics Engineering Lab	-	-	2	1
TOTAL			**16**	**1**	**10**	**22**

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-II	3	1	-	4
2		Web Programming with Python and Java Script	3	-	-	3
3		Engineering Workshop	1	-	-	1
4		AECC - 2*	2	-	-	2
5		VAC – 2**	2	-	-	2
6		Web Programming with Python and Java Script Lab	-	-	2	1
7		Engineering Workshop Lab	-	-	4	2
TOTAL			**11**	**1**	**06**	**15**

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

* At the end of first year the student is capable of working as web developer either as full-time employee or as a freelancer.

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1#	4	-	-	4
6		VAC – 3**	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Summer Internship-I	-	-	-	1
TOTAL			**18**	**-**	**8**	**23**

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2#	4	-	-	4
6		VAC – 4**	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
TOTAL			**18**	**2**	**6**	**23**

*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 well-versed with programming fundamentals and database systems. Student is expected to be placed as initial level software developers, system operators and other production IT staff in software industry.

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3#	4	-	-	4
6		AECC – 3*	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Summer Internship-II	-	-	-	1
TOTAL			**18**	**1**	**4**	**22**

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
TOTAL			**15**	**1**	**10**	**22**

*The students are compulsorily need to undergo 8 weeks of summer internship immediately after 6th semester.

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Summer Internship-III	-	-	-	2
TOTAL			**6**	**0**	**20**	**18**

SEMESTER VIII

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

Total Credits: 161

Table1: List of Program Electives

Program Electives	Course	Semester
PE-I	Artificial Intelligence	6
PE-I	Cloud Computing	6
PE-I	DevOps	6
PE-II	Image Processing	6
PE-II	Cyber Security	6
PE-II	Data Mining	6
PE-III	Data Analytics	7
PE-III	Internet of Things	7
PE-III	Virtual Reality	7
PE-IV	Blockchains	7
PE-IV	Natural Language Processing	7
PE-IV	Soft Computing	7

Additional Qualifications:

a. The students will have options of selecting the electives from the Artificial Intelligence and Machine Learning and Full Stack Development (iOS) baskets depending on the specialization they wish to acquire. Refer to Table 2 for list of subjects.

Number of specialisation courses	What students will get
Completed less than 4 specialisation courses	Certificates for each course
Completed at least 5 or more courses in one area	(a) Certificates for each course (b) Minor in concerned area (e.g. BTech in CSE with a minor in AI and ML)
Completed at least 6 courses but NOT completed 5 courses in any one area	(a) Certificates for each course (b) B Tech with Honours
Completed at least 6 courses AND 4 or more courses in any one area	(a) Certificates for each course (b) B Tech with Honours (c) Minor in concerned area

b. The students will have options of selecting the electives from Blockchains, Cyber Security and Data Science baskets depending on the specialization they wish to acquire. Refer to Table 3(a), Table 3(b) and Table 3(c) for list of subjects for the above said specializations.

Number of specialisation courses	What students will get
Completed less than 4 specialisation courses	(a) Certificates for each course
Completed all 5 courses in one area	(a) Certificates for each course (b) B Tech with Honours (c) Minor in concerned area

Flexibility of Specializations:

1. It is expected that majority of students will complete all courses in a single specialisation along with their cohort.
2. Few students would like to take one or more courses from other specialisations. They can be permitted to register for a course from a different specialisation provided they have done the pre-requisite course.
    - eg. Completing introductory course in python essential for registering for a course in Deep Learning or Neural Networks.
    - Pre-requisites of each specialisation will be clearly spelled out.
    - A particular specialisation course may have students from any year of any
    - branch provided the student has paid specialisation fee and has done the
    - pre-requisite course (if any).

Table 2: List of subjects offered for minors in Artificial Intelligence and Machine Learning and Full Stack Development (iOS) baskets.

Semester	Artificial Intelligence and Machine Learning	Full Stack Development (iOS)	L	T	P	C
1	Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain	Basic Architecture of Mac OS X with UID Fundamentals	3	0	2	4
2	Data Analysis using Python	Full Stack Web Development & DevOps	3	0	2	4
3	Probabilistic Modelling and Reasoning with Python	iOS Fundamentals & Swift Programming Language	3	0	2	4
4	R programming	Backend Web Development	3	0	2	4
5	Machine Learning and Pattern Recognition	Mobile Application Development/ iOS Basic	3	0	2	4
6	Neural Networks and Deep Learning	Mobile Application Development/ iOS Advanced	3	0	2	4

7	Data Visualization	iOS Practical Implementation Techniques - Mini Project in an Industry.	3	0	2	4

Total Credits: 161 + 28 = 189

Table 3 (a): List of subjects for minors in Blockchains

Semester	Blockchains	L	T	P	C
3	Fundamentals of Blockchain	3	0	0	3
4	Smart Contracts and Solidity	3	0	2	4
5	Blockchain Platforms and Use cases	3	0	2	4
6	Blockchain Security and Performance	3	0	2	4
7	Blockchain and FinTech	3	0	0	3

Total Credits: 161 + 18 = 179

Table 3 (b): List of subjects for minors in Cyber Security

Semester	Cyber Security	L	T	P	C
3	Information Theory for Cyber Security	3	0	2	4
4	Data Encryption	3	0	2	4
5	Steganography and Digital Watermarking	3	0	0	3
6	Security Assessment and Risk Analysis	3	0	0	3
7	Database Security and Access Control	3	0	2	4

Total Credits: 161 + 18 = 179

Table 3 (c): List of subjects for minors in Data Science

Semester	Data Science	L	T	P	C
3	Introduction to Data Science	3	0	2	4
4	Introduction to AI and ML	3	0	2	4
5	Computational Data Analytics	3	0	2	4
6	Web Data Mining	3	0	0	3
7	Analysing, Visualizing and Applying Data science with Python	3	0	2	4

Total Credits: 161 + 19 = 180

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

B.Tech (Computer Science & Engineering)

Semester I

S.No	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-I	3	1	-	4
2		Web Development	3	-	-	3
3		Basics of Electrical & Electronics Engineering	3	-	-	3
4		Programming for Problem Solving	3	-	-	3
5		AECC -1*	2	-	-	2
6		VAC – 1**	2	-	-	2
7		Programming for Problem Solving Lab	-	-	4	2
8		Web Development Lab	-	-	2	1
9		Python Programming Lab	-	-	2	1
10		Basics of Electrical & Electronics Engineering Lab	-	-	2	1
TOTAL			**16**	**1**	**10**	**22**

1. Name of the Department- Computer Science Engineering							
2. Course Name	**Engineering Mathematics - I**	**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

The concepts of mathematics-I are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics.

9. Learning objectives:

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

10. Course Outcomes (COs):

The students will learn:

1. The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

Unit wise detailed content

Unit-1	**Number of lectures = 12**	

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, Linear Independence, rank of a matrix; inverse of a matrix, Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors, eigenbases; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Unit – 2	**Number of lectures = 8**	

Cramer's Rule, Gauss elimination and Gauss-Jordan elimination, Gram-Schmidt orthogonalization.

Unit – 3	**Number of lectures = 10**	

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

Unit – 4	**Number of lectures = 10**	

Laplace Transforms & Inverse Laplace Transforms; Solution based on Definition, change of scale property, 1st & 2nd shifting properties, LT division by t, LT of derivative, LT by multiplication by t, Convolution th. & application on LT & Inverse LT.

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:

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Books Recommended

Text Books

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Web Development</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">HTML and CSS go hand in hand for developing flexible, attractively and user friendly websites. HTML (Hyper Text Markup Language) is used to show content on the page where as CSS is used for presenting the page. HTML describes the structure of a Website semantically along with presentation cues, making it a mark-up language, rather than a programming language. HTML allows images and objects to be embedded and can be used to create interactive forms.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. HTML is highly flexible and supported on all browsers.
2. User friendly and an open technology.
3. CSS provides powerful control over the presentation of an HTML document.
4. CSS can be used to make responsive web pages, which are compatible on multiple devices. It can be used to allow the web pages to display differently depending on the screen size or device on which it is being viewed.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">The students will learn:
1. Student will have a basic & thorough understanding of HTML & CSS
2. Focus on building HTML & CSS web page
3. Start building beautiful websites
4. Build a portfolio website, so you can highlight your best web work.</td></tr>
<tr><td colspan="8">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">World Wide Web, Internet, Introduction to Markup Language, Structure of a website, Your first website, Headings, Paragraphs, Links, Images, Inline vs Block Elements, Iframes, Unordered Lists, Ordered Lists, Description Lists, Tables, Entities, Forms, Text Decoration, Comments</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
</table>

Introduction to CSS, Inline CSS, Internal CSS, External CSS, Classes and IDs, Div and Span, Box Model, Box Model : Padding, Border, Outline, Margin, Background, Floating, Positioning, Display, Text Decoration, Text Align, Text Fonts, Text effects, Image sprites, Image Opacity, Styling lists, Styling links, Gradients, 2D-transformations, 3D-transformations, Transitions animations

Bootstrap: Getting started with Bootstrap, Setup templates and Navbar, Typography forms and tables, CSS components, Grid systems, Modal, Dropdown, tabs & tooltip, Collapse, accordion and carousel, Custom bootstrap theme.

Unit – 3	**Number of lectures = 10**	

Jquery: Getting started with Jquery, Selectors and Mouse events, Form events, DOM manipulation, Effects & animation, Traversing and filtering

Ajax: Introduction, Technologies, Examples, Browser support, Action, XMLHTTP request, Database operation, Security, Issues

Unit – 4	**Number of lectures = 10**	

PHP: Introduction, Embed PHP in HTML, PHP variable, Data types: String, Integer & floats, Boolean, objects, Array, null, resources, String functions, if and switch statements, for loops, While loops, Functions, Get & POST, Array functions, Send emails, Filter user inputs, Data & time, Include PHP files, File handling, Upload files, Cookies, Error Handling, Sessions

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Online Resources:

https://www.coursera.org/learn/web-development

Books Recommended

Text Books

Jon Duckett's "HTML and CSS design and build websites", ISBN-13: 978-1118008188, ISBN-10: 1118008189

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<tr><td colspan="2">2. Course Name</td><td colspan="2">Web Development Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
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<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">HTML and CSS go hand in hand for developing flexible, attractively and user friendly websites. HTML (Hyper Text Markup Language) is used to show content on the page where as CSS is used for presenting the page. HTML describes the structure of a Website semantically along with presentation cues, making it a mark-up language, rather than a programming language. HTML allows images and objects to be embedded and can be used to create interactive forms.</td></tr>
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Course Objectives:
1. HTML is highly flexible and supported on all browsers.
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3. CSS provides powerful control over the presentation of an HTML document.
4. CSS can be used to make responsive web pages, which are compatible on multiple devices. It can be used to allow the web pages to display differently depending on the screen size or device on which it is being viewed.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">The students will learn:
1. Create Simple web pages using HTML & DHTML
2. Create Web pages using HTML5 tags
3. Create client-side validation scripts.
4. Create Web applications using AJAX</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
</table>

1. Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages.

2. Create a HTML form for reading Name, Age, Gender, Address, Payment Options, Phone number, Email address, preferred user name, various Area of Interest etc from the user.

3. Create a simple webpage using HTML frames to Include Images and Videos.

4. Write a Java Script program to validate the data including the email id entered by the user in the above form are in correct format. Display error message if input is not in correct format. Call the script when the page is submitted.

5. Create web page to display the rule and regulations for University Examination. Include the content from a separate file. Also display the information like last modified time size of file. Use SSI concept for the above task.

6. Simple application to demonstrate Servlets.

7. Design a simple online test web page in PHP

8. Write a PHP program to implement a session-based counter.

9. Write a PHP program to input previous reading and present reading and prepare an electricity bill.

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Online Resources:

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1. Name of the Department- Computer Science Engineering						
2. Course Name	**Basics of Electrical and Electronics Engineering**	**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 consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

9. Learning objectives:

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

10. Course Outcomes (COs): On completion of course student is able to:

a) Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.

b) Determine an understanding of logic gates.

c) Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.

d) Create an understanding of semiconductor devices application to existing devices.

e) Learn the basics of electronics devices used in practical application.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition Theorem, Thevenin's Theorem, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit – 2	**Number of lectures = 10**	
A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth. **Cathode Ray Oscilloscope:** Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component		
Unit – 3	**Number of lectures = 10**	
. **Semiconductor Physics:** Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents. **P-N junction diode**: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation. **Special Diodes**: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.		
Unit – 4	**Number of lectures = 10**	
Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates **Bipolar junction transistor:** Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents. **Application of BJT:** CB, CE configurations, Introduction to FETs and MOSFETs.		
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13. Books Recommended		
Text Books 1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi. 2. B L Thareja – A text book of Electrical Technology 3. Boylestad&Nashelsky, “Electronic Devices & Circuits”, Pearson Education, 10th Edition. 4. V. K. Mehta & Rohit Mehta, “Principles of Electronics”, S. Chand Publishers, 27th Edition.		

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Basics of Electrical and Electronics Engineering Lab**	**L**	**T**		**P**	
3. Course Code		**0**	**0**		**2**	
4. Type of Course (use tick mark)		**Core ( )**	**PE()**		**OE ()**	
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a) Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.

b) Determine an understanding of logic gates.

c) Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.

d) Create an understanding of semiconductor devices application to existing devices.

e) Learn the basics of electronics devices used in practical application.

11. List of Experiments Tentative

1. To get familiar with the working knowledge of the following instruments:
   a) Cathode ray oscilloscope (CRO)
   b) Multimeter (Analog and Digital)
   c) Function generator
   d) Power supply

2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem
4. To Verify the Superposition theorem
5. To measure voltage, current and power in an A.C. circuit by LCR impedance method
6. To study the frequency response curve in series and parallel R-L-C circuit
7. a) Plot the forward and reverse V-I characteristics of P-N junction diode
   b) Calculation of cut-in voltage
   c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

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/108108076

13. Books Recommended

Text Books

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Programming for Problem Solving**	**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:

Course 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):

The students will learn:

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.
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.		
Unit – 2	**Number of lectures = 10**	
Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms.		
Unit – 3	**Number of lectures = 10**	
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 etc. Finding roots of equations, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Quick sort.		
Unit – 4	**Number of lectures = 10**	
Structures, Defining structures and Array of Structures Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)		

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/106105171

https://nptel.ac.in/courses/106104074

Books Recommended

Text Books

(i) Byron Gottfried, Schaum‘s Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Programming for Problem Solving 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

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:

Course Objectives:

- Provide an understanding of the role computation can play in solving problems.
- Master the fundamentals of writing Python scripts.
- Learn core Python scripting elements such as variables and flow control structures.
- Discover how to work with lists and sequence data.
- Position students so that they can compete for projects and excel in subjects with programming components.

10. Course Outcomes (COs):

The students will learn:

1. To learn the syntax and semantics of Python programming language
2. To use the structural programming approach in solving the problem.
3. To use the object oriented programming approach in solving problems
4. To handle exceptions gracefully
5. To develop searching and sorting algorithms structures.

11. List of Experiments (Indicative)

1. Develop programs to implement list
2. Develop programs to implement Dictionary
3. Develop programs to implement tuples
4. Develop programs to understand the control structures of python
5. Develop programs to implement function with stress on scoping
6. Develop programs to implement classes and objects

7. Develop programs to implement exception handling.
8. Develop programs to implement linear search and binary search.
9. Develop programs to implement insertion sort
10. Develop programs to implement bubble sort.
11. Develop programs to implement quick sort.
12. Develop programs to implement heap sort.

1. 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/106106182

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Python Programming Lab</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="4">4. Type of Course (use tick mark)</td><td colspan="2">Core ( )</td><td colspan="2">PE ()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td colspan="8">9. Learning objectives:
Course 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</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">The students will learn:
2. To formulate the algorithms for simple problems
3. To translate given algorithms to a working and correct program
4. To be able to correct syntax errors as reported by the compilers
5. To be able to identify and correct logical errors encountered at run time
6. To be able to write iterative as well as recursive programs
7. To be able to represent data in arrays, strings and structures and manipulate them through a program
8. To be able to declare pointers of different types and use them in defining self-referential structures.</td></tr>
<tr><td colspan="8">11. List of Experiments (Indicative)</td></tr>
<tr><td colspan="8">Lab1: Familiarization with programming environment
Lab 2: Simple computational problems using arithmetic expressions
Lab 3: Problems involving if-then-else structures
Lab 4: Iterative problems e.g., sum of series
Lab 5: 1D Array manipulation
Lab 6: Matrix problems, String operations</td></tr>
</table>

Lab 7: Simple functions

Lab 8 and 9: Programming for solving Numerical methods problems

Lab 10: Recursive functions

Lab 11: Structures and Pointers

9. 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/106105171

https://nptel.ac.in/courses/106104074

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-II	3	1	-	4
2		Web Programming with Python and Java Script	3	-	-	3
3		Engineering Workshop	1	-	4	1
4		AECC - 2*	2	-	-	2
5		VAC – 2**	2	-	-	2
6		Web Programming with Python and Java Script Lab	-	-	2	1
7		Engineering Workshop Lab	-	-	4	2
TOTAL			**11**	**1**	**06**	**15**

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

* At the end of first year the student is capable of working as web developer either as full-time employee or as a freelancer.

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Mathematics - II**	**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

The concepts of mathematics-II are introduce students to the basic concepts and logic of statistical reasoning and gives the students introductory-level practical ability to choose, generate, and properly interpret appropriate descriptive and inferential methods.

9. Learning objectives:

The objective of this course is to familiarize the students with probability and statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

10. Course Outcomes (COs):

The students will learn:

1. The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2. The basic ideas of statistics including measures of central tendency, correlation and regression.
3. The statistical methods of studying data samples.

Unit wise detailed content

Unit-1	**Number of lectures = 12**	

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete; Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit – 2	**Number of lectures = 8**	

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Unit – 3	**Number of lectures = 10**	

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Unit – 4	**Number of lectures = 10**	

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

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/111106112

https://nptel.ac.in/courses/111105090

Books Recommended

Text Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Web Programming with Python and Java Script</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Python Programming</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9">This course concerns with the design and implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Topics include database design, scalability, security, and user experience. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.</td></tr>
<tr><td colspan="9">9. Learning objectives:
1. Provide an understanding of the role computation can play in solving problems.
2. Master the fundamentals of Django framework.
3. Discover how to work with Git and GitHub.
4. Position students so that they can create, share, test and deploy web application projects.</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">The students will learn:
1. To design simple web pages using HTML and CSS
2. To use GIT and GIT HUB for project management
3. To apply Django web framework to create websites
4. To create interactive and responsive website using Javascript
5. To test and deploy application web applications</td></tr>
<tr><td colspan="9">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Introduction, Web Programming, HTML (Hypertext Markup Language), Document Object Model (DOM), More HTML Elements, Forms, CSS (Cascading Style Sheets), Responsive Design, Bootstrap, SASS (Syntactically Awesome Style Sheets), Introduction to Git, GitHub, Commits, Merge Conflicts, Branching, More GitHub Features</td></tr>
</table>

Unit – 2	**Number of lectures = 10**	

Decorators and Lambda Function in Python, Introduction to Web Applications, HTTP, Django, Routes, Templates: Conditionals and Styling, Tasks, Forms: Django Forms, Sessions

Introduction to SQL: Databases, Column Types; Tables ; SELECT: Working with SQL in the Terminal, Functions, UPDATE, DELETE, Other Clauses, Joining Tables: JOIN Query, Indexing, SQL Vulnerabilities;

Django Models, Migrations, Shell: Starting our application, Django Admin, Many-to-Many Relationships, Users

Unit – 3	**Number of lectures = 10**	

Introduction to JavaScript, Events, Variables, query Selector, DOM Manipulation: JavaScript Console, Arrow Functions, TODO List; Intervals, Local Storage, APIs: JavaScript Objects, Currency Exchange.

Introduction to User Interfaces, Single Page Applications, Scroll: Infinite Scroll; Animation, React: Addition

Unit – 4	**Number of lectures = 10**	

Introduction to Testing, Assert: Test-Driven Development, Unit Testing, Django Testing: Client Testing, Selenium, CI/CD, GitHub Actions, Docker

Scalability, Scaling, Load Balancing, Autoscaling: Server Failure, Scaling Databases: Database Replication, Caching, Security: Git and GitHub, HTML, HTTPS: Secret-Key Cryptography, Public-Key Cryptography, Databases: APIs, Environment Variables;
JavaScript: Cross-Site Request Forgery

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.edx.org/course/cs50s-web-programming-with-python-and-javascript

Books Recommended

Text Books

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson
2. Django for APIs: Build web APIs with Python and Django, Willam S. Vincent,
3. Web Technologies, Uttam K. Roy, Oxford University Press

4. SQL, PL/SQL: Programming Language of Oracle, Ivan Bayross, BPB Publications

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Web Programming with Python and Java Script 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)	**Python Programming**	**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 = 28**			

8. Course Description

This course concerns with the design and implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Topics include database design, scalability, security, and user experience. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.

9. Learning objectives:

Course Objectives:

5. Provide an understanding of the role computation can play in solving problems.
6. Master the fundamentals of Django framework.
7. Discover how to work with Git and GitHub.
8. Position students so that they can create, share, test and deploy web application projects.

10. Course Outcomes (Cos):

The students will learn:

1. To design simple web pages using HTML and CSS
2. To use GIT and GIT HUB for project management
3. To apply Django web framework to create websites
4. To create interactive and responsive website using Javascript
5. To test and deploy application web applications

List of Experiments (Indicative)

1. Practice the command line to

a) install and configure git.

b) Create a git folder and initialize Git on that folder.

c) Add files to Git folder

d) Get use to stagged environment

e) Practice commit

2. Practice the command line to

a) Working with Git Branches

b) Switch between various branches of Git.

c) Working with Git Merge.

d) Working with Pull command of Git

e) Working with Push command of Git.

3. Write a program to demonstrate the use of decorators using Python.

4. Write a program to demonstrate the use of lambda, map, and filter function in Python.

5. Design a Database and create required tables. E.g. Bank, College Database

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

7. Write a sql statement for implementing ALTER, UPDATE and DELETE

8. Write the queries to implement the joins

9. Write the query for implementing the following functions: MAX(), MIN(),AVG(),COUNT()

10. Design signup form to validate username, password, and phone numbers etc using JavaScript.

11. Write a JavaScript program to determine whether a given year is a leap year in the Gregorian calendar.

12. Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit

13. Create a website using Django to build blog applications that have the (CRUD) Create, Read, Update, Delete functionality. (https://www.datacamp.com/tutorial/web-development-django)

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.edx.org/course/cs50s-web-programming-with-python-and-javascript

1. Name of the Department- Computer Science & Engineering						
2. Course Name	**Engineering Workshop**	**L**	**T**		**P**	
3. Course Code		1	0		0	
4. Type of Course (use tick mark)		**Core ()**	**PE ()**		**OE ()**	**EAS ( )**
5. Pre-requisite (if any)	**NIL**	**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 = 14		**Tutorials = 0**	**Practical = 56**			

8. Course Description

Workshop technology deals with different processes by which components of a machine or equipment are made. The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

9. Learning objectives: After the completion of the course, the student shall be able to

- **i)** Practice workshop safety rules effectively and acquire knowledge and use simple hand tools.
- **ii)** Acquire knowledge and use simple measuring and gauging instruments.
- **iii)** Operate various machine tools for producing simple metal components and articles.
- **iv)** Acquire knowledge and practice on foundry, forging and welding.
- **v)** Acquire knowledge and analyse basic electrical and electronics circuits.

10. Course Outcomes (COs): On completion of this course, the students will be able to

- **i)** Gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
- **ii)** Fabricate components with their own hands.
- **iii)** Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. Also, able to study and analyse different electrical signals.
- **iv)** Gain Knowledge of the basics of electrical & electronics circuits and able to design their own components.

11. Unit wise detailed content

Unit-1	**Number of Tutorials = 3**	**Title of the unit: Manufacturing Processes**

Introduction to Manufacturing Processes and their Classification, additive manufacturing, Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accident, Methods of Safety, First Aid, Objectives of Layout, Types of Plant Layout and their Advantages.

Unit – 2	**Number of Tutorials = 3**	**Title of the unit: Carpentry, Fitting & Forming Processes**

Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning.

Sheet Metal Operations: Measuring Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining. Advantages of timber, types of timber, defects in timber, carpentry tools, classification of metals, fitting tools, fitting operations, and glass cutting.		
Unit – 3	**Number of Tutorials = 5**	**Title of the unit: Casting and Machine Tools**
Introduction to Casting Processes, ttern: Types of Pattern and Allowances, Sand Casting: Sand Properties, Constituents and Preparation. Gating System. Melting of Metal, Cupola Furnace, Casting Defects & Remedies, plastic moulding, Lathe machine, lathe operations, CNC machining, Shaper and planner machine. Introduction to welding, Classification of Welding Processes, Welding Defects and Remedies, Soldering & Brazing.		
Unit – 4	**Number of Tutorials = 3**	**Title of the unit: Electrical & Electronics**
Electrical: - Measure the voltage, current, frequency, phase difference, power, and power factor for single and three-phase supply, Wire fan, tube light, two-way control, Wire MCB, ELCB for a given load circuit. **Electronics: -** Introduction to basic electronics components, Controller and its testing: Resistors, Inductors, Capacitor, Diode, BJT, Introduction to testing and Measurement Instruments: Power Supply, Function Generator, Oscilloscope		
13. 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://sgtlms.org		
14. Books Recommended		
Text Book		
i) Workshop Technology Vol. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi., Vol-I: ISBN-10: 8185099146, Vol-II: ISBN: 9788185099156		
Reference Books		
i) Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi, Fourth Edition, ISBN-10: 9788120306639		
ii) Principles of Manufacturing Materials and Processes - Campbell, J.S. - McGraw- Hill, New Edition, ISBN-10: 0070992525		
iii) Manufacturing Science - Amitabha Ghosh & Ashok Kumar Malik, - East-West Press, PEARSON India, Second Edition (2010), ISBN-10: 8176710636		
iv) Workshop Technology (Manufacturing Process) – S K Garg, Laxmi Publications; Fourth Edition (2018), ISBN-10: 8131806979		

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Engineering Workshop Lab**	**L**	**T**		**P**	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		**Core ()**	**PE ()**		**OE ()**	**EAS (✓)**
5. Pre-requisite (if any)	**NIL**	**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 = 14		**Tutorials = 0**	**Practical = 56**			

8. Course Description

Workshop technology deals with different processes by which components of a machine or equipment are made. The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

9. Learning objectives: After the completion of the course, the student shall be able to

vi) Practice workshop safety rules effectively and acquire knowledge and use simple hand tools.
vii) Acquire knowledge and use simple measuring and gauging instruments.
viii) Operate various machine tools for producing simple metal components and articles.
ix) Acquire knowledge and practice on foundry, forging and welding.
x) Acquire knowledge and analyse basic electrical and electronics circuits.

10. Course Outcomes (COs): On completion of this course, the students will be able to

v) Gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
vi) Fabricate components with their own hands.
vii) Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. Also, able to study and analyse different electrical signals.
viii) Gain Knowledge of the basics of electrical & electronics circuits and able to design their own components.

11. List of Experiments

1	To study different types of measuring tools used in metrology and determine the least counts of vernier callipers, micrometers and vernier height gauges.
2	To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off
3	To study different types of fitting tools and marking tools used in fitting practice.
4	To prepare a layout on a metal sheet by making and prepare rectangular tray pipe-shaped components e.g., funnel.
5.	To prepare joints for welding suitable for butt welding and lap welding.
6	To study various types of carpentry tools and prepare simple types of at least two wooden joints.
7	Measurement of voltage and current by multimeter and perform testing of various components.
8	To study cathode ray oscilloscope and perform measurements for a different signal.

9	To study 1) Safety precaution. 2) Electrical safety devices & protection like MCB, ELCB and Fuse.
10	To prepare of wiring diagram 1) Ceiling fan and Tube light 2) Two-way control switch.
11	To study the breadboard and PCB connection for Electronics circuit
12	To study soldering and de-soldering techniques for Electronics circuits.
13	To study different case studies using Arduino.

Note:

1. At least ten experiments/ jobs are to be performed/ prepared by students in the semester.
2. At least 8 experiments/ jobs should be performed/prepared from the above list, the remaining two may either be performed/prepared from the above list or designed and set as per the scope of the syllabus of Workshop Technology.

15. 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/

16. Books Recommended

Text Book

ii) Workshop Technology Vol. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi., Vol-I: ISBN-10: 8185099146, Vol-II: ISBN: 9788185099156

Reference Books

v) Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi, Fourth Edition, ISBN-10: 9788120306639

vi) Principles of Manufacturing Materials and Processes - Campbell, J.S. - McGraw- Hill, New Edition, ISBN-10: 0070992525

vii) Manufacturing Science - Amitabha Ghosh & Ashok Kumar Malik, - East-West Press, PEARSON India, Second Edition (2010), ISBN-10: 8176710636

viii) Workshop Technology (Manufacturing Process) – S K Garg, Laxmi Publications; Fourth Edition (2018), ISBN-10: 8131806979

Semester III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Summer Internship-I	-	-	-	1
TOTAL			**18**	**-**	**8**	**23**

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Introduction to MATLAB**	**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

These programming languages are difficult to use when solving engineering problems. Students therefore often do not reinforce their programming skills and lose a potentially valuable tool. It is important that the programming projects consist of problems that the students can relate to and identify with. Also, the required math and engineering principles need to be presented in an elementary and clear way. This requires starting out with elementary problems and subsequently increasing their complexity. MATLAB has enough programming constructs to introduce programming in an introductory course and features a host of advanced application-specific functions. It also includes graphical user interfaces, debugging tools, and symbolic mathematics.

9. Learning objectives:

Exposing students to many techniques and capabilities in MATLAB will enhance ability to use computing tools and languages to solve engineering problems in academic and professional career.

10. Course Outcomes (COs):

- **f)** Student will learn fundamental computer programming concepts such as variables, control structures, functions and many others.
- **g)** Student will learn the powerful support MATLAB provides for working with matrices.
- **h)** Student will learn about various data types and how to handle them in MATLAB.
- **i)** Student will learn about file input/output.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Introduction to MATLAB: Brief Introduction, Installation of MATLAB, History, Use of MATLAB, Key features, MATLAB Window, Command Window, Workspace, Command history, Setting directory, Working with the MATLAB user interface, Basic commands, Assigning variables, Operations with variables, Data files and Data types: Character and string, Arrays and vectors, Column vectors, Row vectors, Arithmetic operations, Operators and special characters, Mathematical and logical operators, Solving arithmetic equations.

Unit – 2	**Number of lectures = 10**	

Operations: Crating rows and columns Matrix, Matrix operations: Finding transpose, determinant and inverse, Solving matrix, Trigonometric functions, Complex numbers, fractions, Real numbers, Complex numbers, Working with script tools, Writing Script file, Executing script files, The MATLAB Editor, Saving m files

Plots: Plotting vector and matrix data, Plot labelling, curve labelling and editing, Basic Plotting Functions, Creating a Plot Plotting Multiple Data Sets in One Graph, Specifying Line Styles and Colors, Graphing Imaginary and Complex Data Figure, Windows Displaying, Multiple Plots in One Figure, Controlling the Axes, Creating Mesh and Surface About Mesh and Surface Visualizing Subplots		
Unit – 3	**Number of lectures = 10**	
MATLAB Simulink: Introduction of Simulink, Simulink Environment & Interface, Study of Library, Circuit Oriented Design, Equation Oriented Design, Model Subsystem Design, Connect Call back to subsystem, Application Automating commands with scripts, writing programs with logic and flow control, Control statement, Programming Conditional Statement, Writing functions, Programming, Examples		
Unit – 4	**Number of lectures = 10**	
Symbolic Math in MATLAB: Calculus: Numerical Integration, Linear Algebra, Roots of Polynomials, Algebraic equations, Differential Equations (1st& 2nd order), Transforms (Fourier, Laplace, etc), Ordinary Differential equations, Examples of few ODEs.		
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/learn/matlab		
13. Books Recommended		
Text Books 1. MATLAB for Engineers, Holly Moore		

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Introduction to MATLAB</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td>0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( ))</td><td>PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">These programming languages are difficult to use when solving engineering problems. Students therefore often do not reinforce their programming skills and lose a potentially valuable tool. It is important that the programming projects consist of problems that the students can relate to and identify with. Also, the required math and engineering principles need to be presented in an elementary and clear way. This requires starting out with elementary problems and subsequently increasing their complexity. MATLAB has enough programming constructs to introduce programming in an introductory course and features a host of advanced application-specific functions. It also includes graphical user interfaces, debugging tools, and symbolic mathematics.</td></tr>
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b) Student will learn the powerful support MATLAB provides for working with matrices.
c) Student will learn about various data types and how to handle them in MATLAB.
d) Student will learn about file input/output.</td></tr>
<tr><td colspan="8">11. List of Experiments</td></tr>
<tr><td colspan="8">1. To Know the history, features and local environment of MATLAB

2. Calculate the area enclosed between the x-axis, and the curve y=x3-2x+5 and the ordinates x = 1 and x = 2.

3. Find the addition, subtraction and multiplication of 3 * 3 matrix.

4. Find the transpose of given matrix

5. Find the inverse of given matrix

6. find the rank of matrix

7. Find the eigen value and eigen vector of matrix

8. Solve $(D^2 + 5\,D + 6)y = e^x$

9. Solve $\int_0^5 \int_0^{x^2} x(x^2 + y^2)dxdy$</td></tr>
</table>

10. Plot the surface for 2 + cos t
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:

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.
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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.

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.

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

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<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Operating System</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ( )</td><td>PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()
Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">Unit wise detailed content</td></tr>
</table>

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)

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

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<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
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<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>2</td></tr>
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<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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.</td></tr>
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5. To learn to implement simple OS mechanisms</td></tr>
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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.</td></tr>
<tr><td colspan="8">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</td></tr>
</table>

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

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.

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Books Recommended

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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	**Digital Electronics**	**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

Digital Electronics is one of the important subjects for students of Computer or electronics background. This course helps you to understand the basic gates, the design of digital circuits using basic gates & the minimization of Boolean expressions using K-maps & logic gates. The digital electronics courses explain about different number system with different number bases which play a very important part in computer world

9. Learning objectives:

1. Explain the elements of digital system abstractions
2. Design simple digital systems based on these digital abstractions
3. Create the appropriate truth table from a description of a combinational logic function
4. Describe the operation and timing constraints for latches and registers

10. Course Outcomes (COs): On completion of course student will demonstrate the ability to:

a) Understand working of logic families and logic gates.

b) Design and implement Combinational circuits.

c) Design and implement Sequential logic circuits

d) Understand working of logic families and logic gates.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes

Unit – 2	**Number of lectures = 10**	

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, parity checker/generator, code converters, priority encoders

Unit – 3	**Number of lectures = 10**	

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters		
Unit – 4	**Number of lectures = 10**	
Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM)		
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/108105132		
13. Books Recommended		
Text Books 1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009. 2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016. 3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.		

Semester IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2#	4	-	-	4
6		VAC – 4**	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
TOTAL			**18**	**2**	**6**	**23**

*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 well-versed with programming fundamentals and database systems. Student is expected to be placed as initial level software developers, system operators and other production IT staff in software industry.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Discrete Mathematics</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">1</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( ))</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="3">Tutorials = 14</td><td colspan="3">Practical = 0</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="9">9. Learning objectives:
Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:
1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3.For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean Algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.</td></tr>
<tr><td colspan="9">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td>Number of lectures = 10</td><td colspan="6"></td></tr>
<tr><td colspan="9">Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.</td></tr>
</table>

Unit – 2	**Number of lectures = 10**	
Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.		
Unit – 3	**Number of lectures = 10**	
Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form		
Unit – 4	**Number of lectures = 10**	
Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.		
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. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill 2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc. 3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill. **Suggested Reference books:** 1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill 2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, 3. Discrete Mathematics, Tata McGraw - Hill		

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Design and Analysis of 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)		**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 introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

9. Learning objectives:

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

10. Course Outcomes (COs):

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

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit – 2	**Number of lectures = 10**	
Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.		
Unit – 3	**Number of lectures = 10**	
Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.		
Unit – 4	**Number of lectures = 10**	
Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE		

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/106106131

13. Books Recommended

Text Books

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Design and Analysis of Algorithms Lab</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">0</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( ))</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
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4. Student should be able to come up with analysis of efficiency and proofs of correctness.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
On completion of this course, the students will be able to
CO 1 Analyze the asymptotic performance of algorithms.
CO 2 Write rigorous correctness proofs for algorithms.
CO 3 Demonstrate a familiarity with major algorithms and data structures.
CO 4 Apply important algorithmic design paradigms and methods of analysis.
CO 5 Synthesize efficient algorithms in common engineering design situations.</td></tr>
<tr><td colspan="8">11. List of Experiment
1.To analyze time complexity of insertion sort
2.To analyze time complexity of Quick sort
3.To analyze time complexity of merge sort
4.Implement Largest Common Subsequence.
5.To Implement Optimal Binary Search Tree.</td></tr>
</table>

6.To Implement Matrix Chain Multiplication.

7.To Implement Strassen's matrix multiplication Algorithm.

8.To implement Knapsack Problem.

9.To implement Activity Selection Problem.

10.To implement Dijkstra's Algorithm.

11.To implement Warshall's Algorithm.

12.To implement Bellman Ford's Algorithm.

13.To implement Depth First Search Algorithm.

14.To implement Breadth First Search Algorithm.

15.To implement NaïveString MatchingAlgorithm.

16.To implement Rabin Karp String MatchingAlgorithm

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

3. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
4. Fundamentals of Algorithms – E. Horowitz et al.

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

consistency, isolation, and durability.

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

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,

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/content/syllabus_pdf/106105175.pdf

https://nptel.ac.in/courses/106/104/106104135

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

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Database Management Systems Lab</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td colspan="9">5. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">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</td></tr>
</table>

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.

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.

6. 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		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3#	4	-	-	4
6		AECC – 3*	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Summer Internship-II	-	-	-	1
TOTAL			**18**	**1**	**4**	**22**

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Formal Language and Automata Theory**	**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 = 14**	**Practical = 0**			

8. Course Description

The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

9. Learning objectives:

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

10. Course Outcomes (COs):

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
4. Distinguish between computability and non-computability and Decidability and undecidability

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, Regular grammars

and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.		
Unit – 2	**Number of lectures = 10**	
Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.		
Unit – 3	**Number of lectures = 10**	
Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.		
Unit – 4	**Number of lectures = 10**	
Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.		

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/106104148

13. Books Recommended

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Suggested reference books:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

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

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		

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_cs19/preview

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.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Computer Networks Lab</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. Help in understanding the concepts of communication and computer networks.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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)</td></tr>
</table>

10. Working on NMAP Tool for Port scanning.

6. 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/

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Software Engineering</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="3">Core ( ))</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="3">Tutorials = 0</td><td colspan="3">Practical = 0</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9">This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.</td></tr>
<tr><td colspan="9">9. Learning objectives:
1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">On completion of this course, the students will be able to:
CO1. To learn and understand the Concepts of Software Engineering
CO2. To Learn and understand Software Development Life Cycle
CO3. To apply the project management and analysis principles to software project development.
CO4. To apply the design & testing principles to software project development.
CO5. Ability to execute tests, design test cases, use test tools, etc.
CO6. To Study about Software maintenance tools</td></tr>
<tr><td colspan="9">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models
Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
</table>

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO, COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding: TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

Unit – 3	**Number of lectures = 10**	

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

Unit – 4	**Number of lectures = 10**	

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

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/106105182

13. Books Recommended

Text Books

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, McGraw Hill Int. Ed.
3. W.S. Jawadekar, “Software Engineering – Principles and Practices”, McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, “Classical & Object Oriented Software Engineering”, IRWIN, TMH.
2. James Peter, W. Pedrycz, “Software Engineering: An Engineering Approach”, John Wiley & Sons.
3. I. Sommerville, “Software Engineering”, Addison Wesley.
4. K. Chandrasehakhar, “Software Engineering & Quality Assurance”, BPB.

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Object Oriented Programming**	**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

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

9. Learning objectives:

1. Explain the concepts of object-oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

10. Course Outcomes (COs):

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

CO1. Learn the syntax of Java Programming Language and implement applications using it.

CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.

CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.

CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.

CO5. Understand multithreading and evaluate exception handing to create new applications.

CO6. Design GUI applications using pre-built frameworks available in Java.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	

Introduction to Java: 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, labeled 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: 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**	

Exceptional 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**	

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 Resource:

https://nptel.ac.in/courses/106105153

13. Books Recommended

Text Books

1. Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Object Oriented Programming 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

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

9. Learning objectives:

1. Explain the concepts of object-oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

10. Course Outcomes (COs):

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

CO1. Learn the syntax of Java Programming Language and implement applications using it.
CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.
CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.
CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.
CO5. Understand multithreading and evaluate exception handing to create new applications.
CO6. Design GUI applications using pre-built frameworks available in Java.

11. List of Experiments

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

2.Write a java program to demonstrate dynamic polymorphism.

3.Write a java program to implement various shapes using Abstract class

4.Write a java program to demonstrate interfaces.

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

6.Create a java programs that make use of all the 5 exception keywords.

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

8.Develop a scientific calculator 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/
13. Books Recommended
Text Books Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Summer Internship - II</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="4">4. Type of Course (use tick mark)</td><td colspan="2">Core ( ))</td><td colspan="2">PE ()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="4">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">Course Content
The students will be evaluated based on 6 weeks of work at industry site aSfter fourth semester. Supervised by an expert at the industry.
Modes of Evaluation: Internship Report, Presentation and Project Review</td></tr>
</table>

Semester VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
TOTAL			**15**	**1**	**10**	**22**

*The students are compulsorily need to undergo 8 weeks of summer internship immediately after 6th semester.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Compiler Design</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">1</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Formal Languages and Automata Theory</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 14</td><td colspan="3">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine..</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">On completion of this course, the students will be able to:-
1. For a given grammar specification develop the lexical analyser
2. For a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine
5. Distinguish between computability and non-computability and Decidability and undecidability</td></tr>
<tr><td colspan="8">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 8</td><td colspan="4">Introduction to Compiling</td></tr>
<tr><td colspan="8">Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.
A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.</td></tr>
</table>

Unit – 2	**Number of lectures = 12**	**Lexical and Syntax Analysis**
The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator. The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.		
Unit – 3	**Number of lectures = 12**	**Syntax-Directed Translation and Run Time Environments**
Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation. **Type Checking**: Type systems, Specification of a simple type checker. **Run-Time Environments**: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.		
Unit – 4	**Number of lectures = 8**	**Code Generation and Code Optimization**
Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions. **Code Generation:** Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs. **Code Optimization**: Introduction, The Principal sources of optimization.		
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/106104072		
Books Recommended		
Text Books **1.** Aho, Ullman & Ravi Sethi, "Principles of Compiler Design", Pearson Education. **2.** Andrew L. Appel, "Modern Compiler Implementation in C", Delhi, Foundation Books.		

Program Elective - I

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Artificial Intelligence</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Fundamentals of Programming</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
</table>

8. Course Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

9. Learning objectives:

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

10. Course Outcomes (COs):

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

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real-world Knowledge representation.
5. Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.

Unit wise detailed content		
Unit-1	**Number of lectures = 8**	
Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree., AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depth first, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction.		
Unit – 2	**Number of lectures = 12**	
Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency.		
Unit – 3	**Number of lectures = 12**	
Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.		
Unit – 4	**Number of lectures = 8**	**Code Generation and Code Optimization**
Perceptron, Gradient descent algorithm, Backpropagation algorithms, Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.		
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/106106126 https://nptel.ac.in/courses/106102220		
Books Recommended		
Text Books 1. Artificial Intelligence, E. Rich and K. Knight, TMH. 2. Artificial Intelligence, P. H. Winston, Pearson Education. **3.** Introduction to AI and Expert Systems, D. W. Patterson, PHI.		

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Artificial Intelligence Lab</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Fundamentals of Programming</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9">The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.</td></tr>
<tr><td colspan="9">9. Learning objectives:
1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">On completion of this course, the students will be able to:-
1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real-world Knowledge representation.
5. Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.</td></tr>
<tr><td colspan="9">List of Experiments (Indicative)</td></tr>
</table>

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

2 Solve any problem using depth first search in Prolog.

3 Solve any problem using best first search in Prolog.

4 Solve 8-puzzle problem using best first search in Prolog.

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

6 Solve traveling salesman problem in Prolog.

7 Write a Program to Implement Tic-Tac-Toe game in Prolog/python.

8 Write a Program to Implement Water-Jug problem.

9 Write a Program to Implement Monkey Banana Problem using Python.

10 Write a Program to Implement N-Queens Problem.

11 Write a Program to Implement Missionaries-Cannibals Problems.

12 Write a program to do reinforcement learning in a grid world.

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/106106126

https://nptel.ac.in/courses/106102220

Books Recommended

Text Books

1. Artificial Intelligence, E. Rich and K. Knight, TMH.
2. Artificial Intelligence, P. H. Winston, Pearson Education.
3. Introduction to AI and Expert Systems, D. W. Patterson, PHI.

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

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 multi core operating systems.

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):

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

1. Implement a public cloud instance using a public cloud service provider.

2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

4. Apply trust-based security model to different layers.

5. Develop a risk-management strategy for moving to the Cloud.

6. Describe big data and use cases from selected business domains.

Unit wise detailed content

Unit-1	**Number of lectures = 10**	
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: Open Stack.		
Unit – 2	**Number of lectures = 8**	
Virtualization 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 = 12**	
Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce. **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.		
Unit – 4	**Number of lectures = 10**	**Code Generation and Code Optimization**
Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud		

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/106/104/106104028/

Books Recommended

Text 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**		**4**	
4. Type of Course (use tick mark)		**Core ()**	**PE ( )**		**OE ()**	
5. Pre-requisite (if any)	Computer Networks	**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 multi core operating systems.

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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):

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

1. Implement a public cloud instance using a public cloud service provider.

2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

4. Apply trust-based security model to different layers.

5. Develop a risk-management strategy for moving to the Cloud.

6. Describe big data and use cases from selected business domains.

List of Experiments (Tentative)

1 Development of applications on Google app engine. 2 Deployment of private Cloud setup through Open Stack 3 Deployment of private Cloud setup through Cloud Stack 4 Case study of XEN/VMware/KVM hypervisor 5 Case study of Amazon EC2. Five more practical's to given by instructor based on theory subjects.
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/106/104/106104028/

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>DevOps</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Software Engineering and Programming for Problem Solving</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
</table>

8. Course Description

Modern software systems are becoming increasingly complex, to meet quality, availability, and security demands. And these systems are changing rapidly to keep up with the needs of end-users.In this course,we look at how the DevOps philosophy can provide a holistic way to look at software development, deployment, and operations. And provide some tenets to help improve quality, and stability.

9. Learning objectives:

DevOps is basically creating a niche or environment that emphasize bringing both development and operational team together. The key objective is to concentrate on the requirements of the project or the entire business requirement.

- **Analysis:** Analysis of the entire business requirement and then gathering the necessary information or data.
- **Design:** Putting all the gathered data into a proper format and then proceed with the development activity.
- **The development teams should develop code: Optimized and ready to move codes**.
- **Compilation:** Simultaneous compilation of codes to keep a check on the beauty of the code.
- **Test:** Without this phase, any software product is not ready for deployment, it is very much needed to go through testing in each phase.

10. Course Outcomes (COs):

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

1. Identify the difference between Agile and Devops.

2. Practice of GitHub

3. Illustrate various Building tools

4. Analyse various Testing tools

5 Illustrate various Configuration management tools		
Unit wise detailed content		
Unit-1	**Number of lectures = 10**	
Learning Objectives, DevOps Overview, Relationship between Agile and DevOps, DevOps Tool chain, Challenges with the traditional approach, Addressing challenges through DevOps, DevOps approach to the challenges, Overview of the DevOps tools, workflow of DevOps, JIRA		
Unit – 2	**Number of lectures = 8**	
VERSION CONTROL SYSTEMS: Overview of version control systems – role of version control systems – Types of control systems and their supporting tools – Overview of Git – Overview of Source code and Version Control hosts – Deploy the files to GitHub.		
Unit – 3	**Number of lectures = 12**	
CONTINUOUS INTEGRATION AND BUILDING TOOL: Importance of continuous Integration, Overview and Features of Jenkins, Set up Jenkins, Overview and Features of Maven,- Setup Maven, Overview and Features of TeamCity, Setup TeamCity		
Unit – 4	**Number of lectures = 10**	**Code Generation and Code Optimization**
SOFTWARE AND AUTOMATION TESTING FRAMEWORKS: Software Testing overview, Testing levels Approach and Automation Tools, Test driven development approaches and JUnit5, Behavior driven development approach with cucumber. CONFIGURATION MANAGEMENT TOOLS: Overview of configuration management tools, overview of puppet, puppet configuration, overview of Chef, Chef configuration, overview of Ansible,Ansible configuration, containerization and Docker.		
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.atlassian.com/software/jira/guides/use-cases/what-is-jira-used-for https://github.com/features https://www.jenkins.io/doc/ http://maven.apache.org/		

https://www.tutorialspoint.com/continuous_integration/continuous_integration_creating_proj ect_teamcity.htm

https://junit.org/junit5/docs/current/user-guide/

https://docker-curriculum.com/

Books Recommended

Text Books

1. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Pearson Education, Inc.2011
2. Jennifer Davis, Katherine Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly, 2016 REFERENCE BOOKS
3. . Gene Kim, Jez Humble, Patrick Debois, and John Willis, THE DEVOPS HANDBOOK How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press, 2016.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">DevOps Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Programming for Problem Solving</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
</table>

8. Course Description

Modern software systems are becoming increasingly complex, to meet quality, availability, and security demands. And these systems are changing rapidly to keep up with the needs of end-users.In this course,we look at how the DevOps philosophy can provide a holistic way to look at software development, deployment, and operations. And provide some tenets to help improve quality, and stability.

9. Learning objectives:

The key objective is to concentrate on the requirements of the project or the entire business requirement.

- **Analysis:** Analysis of the entire business requirement and then gathering the necessary information or data.
- **Design:** Putting all the gathered data into a proper format and then proceed with the development activity.
- **The development teams should develop code: Optimized and ready to move codes**.
- **Compilation:** Simultaneous compilation of codes to keep a check on the beauty of the code.

Test: Without this phase, any software product is not ready for deployment, it is very much needed to go through testing in each phase.

10. Course Outcomes (COs):

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

1. Identify the difference between Agile and Devops.

2. Practice of GitHub

3. Illustrate various Building tools

4. Analyse various Testing tools

5 Illustrate various Configuration management tools

List of Experiments (Tentative)

1. Installing and Configuring Jenkins to Test, And Deploy Java
2. Version Control System with Git
3. Installing and Configuring Docker for Creating Containers Of Different System Images
4. Creating Docker File & Docker Volume
5. Installation and Configuration of Puppet
6. Software Configuration Provisioning Using Chef Management

Five more practical's to given by instructor based on theory subjects.

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:

1. https://www.tutorialspoint.com/puppet/index.htm
2. https://puppet.com/blog/how-get-started-puppet-beginners-guide/
3. https://www.tutorialspoint.com/chef/index.htm
4. https://docs.chef.io/chef_overview/
5. https://www.tutorialspoint.com/ansible/index.htm
6. https://docs.ansible.com/ansible/latest/user_guide/intro_getting_started.html
7. https://docker-curriculum.com/

Program Electives-II

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Image Processing</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">Introductory graduate-level course on image processing for engineering students. No prior image processing experience is expected. The course broadly covers the fundamentals of image processing algorithms.</td></tr>
<tr><td colspan="8">9. Learning objectives:
The objective of this course is to

1. imparts knowledge in the area of image and image processing
2. understand fundamentals of digital image processing
3. provide knowledge of the applications of the theories taught in Digital Image Processing
4. learn the fundamentals of Pattern recognition and to choose an appropriate feature
5. product is not ready for deployment, it is very much needed to go through testing in each phase.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">Upon completion of this course, the students will be able to

1. understand Basics of Image formation and transformation using sampling and quantization
2. understand different types signal processing techniques used for image sharpening and smoothing
3. perform and apply compression and coding techniques used for image data
4. understand the nature and inherent difficulties of the pattern recognition problems
5. understand concepts, trade-offs, and appropriateness of the different feature types and classification techniques such as Bayesian, maximum-likelihood, etc
6. select a suitable classification process, features, and proper classifier to address a desired pattern recognition problem.</td></tr>
<tr><td colspan="8">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Frequency domain transformation techniques and their properties.

Image Acquisition: Energy, the optical system, image sensor and digital image formation. Gray scale and color images</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 12</td><td colspan="4"></td></tr>
</table>

Image Point Processing: Gray-level mapping, non-liner gray-level mapping, image histogram, histogram stretching, histogram equalization, histogram matching, thresholding. Neighborhood Processing: Median filter, mean filter, correlation, templet matching, edge detection and image sharpening. Color image processing.

Morphology: Dilation & errosion, closing & opening and boundary detection

Unit – 3	**Number of lectures = 12**	

Geometric transformations: Translation, rotation, scaling and shearing.

Frequency transformation: Discrete Fourier transform (DFT), fast Fourier transform (FFT) and short-time Fourier transform (STFT), 2-D Fourier transform, 1-D and 2-D filtering.

Multi-resolution Expansions: Pyramidal Multi-resolution analysis, Haar wavelet transforms in 1-D and 2-D, the fast wavelet transform, wavelet packets transform.

Unit – 4	**Number of lectures = 8**	**Code Generation and Code Optimization**

Feature Extraction and Dimension Reduction: Color, Texture, Shape Local Features, Spatial and frequency domain, HOG, Corner Detection, SIFT and SURF, Hough Transform, Principal Component Analysis.

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/106105032

Books Recommended

Text Books

1. J G Proakis and D G Manolakis, "Digital Signal Processing," Pearson, Fourth edition
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Prentice Hall

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Image Processing 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 for Problem Solving	**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

Introductory graduate-level course on image processing for engineering students. No prior image processing experience is expected. The course broadly covers the fundamentals of image processing algorithms.

9. Learning objectives:

The objective of this course is to

1. imparts knowledge in the area of image and image processing
2. understand fundamentals of digital image processing
3. provide knowledge of the applications of the theories taught in Digital Image Processing
4. learn the fundamentals of Pattern recognition and to choose an appropriate feature
5. product is not ready for deployment, it is very much needed to go through testing in each phase.

10. Course Outcomes (COs):

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

1. understand Basics of Image formation and transformation using sampling and quantization
2. understand different types signal processing techniques used for image sharpening and smoothing
3. perform and apply compression and coding techniques used for image data
4. understand the nature and inherent difficulties of the pattern recognition problems
5. understand concepts, trade-offs, and appropriateness of the different feature types and classification techniques such as Bayesian, maximum-likelihood, etc
6. select a suitable classification process, features, and proper classifier to address a desired pattern recognition problem.

List of Experiments (Tentative)

1. Program to extract different Attributes of an Image.

2. Program for Image Negation.

3. Program for Power Law Transformation.

4. Program for Histogram Mapping and Equalization.

5. Program for Image Smoothening and Sharpening.

6. Program for Edge Detection using Sobel, Prewitt and Roberts Operators.

7. Program for Morphological Operations on Binary Images.

8. Program for Pseudo Coloring.

9. Program for Chain Coding.

10. Program for DCT/IDCT Computation.

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/106105032

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Cyber 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)	Basic knowledge of Computers · Basic knowledge of networking and Internet · Hands on Windows operating system	**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

The course has been designed to give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains.The course aims at providing students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.

9. Learning objectives:

The course will help students to gauge understanding in essential techniques in protecting Information Systems, IT infrastructure, analysing and monitoring potential threats and attacks, devising security architecture and implementing security solutions. The students will also have a wider perspective to information security from national security perspective from both technology and legal perspective.

10. Course Outcomes (COs):

After completion of this course, the students should be able to:

1. Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
2. Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios
3. Identify common trade-offs and compromises that are made in the design and development process of Information Systems
4. Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

Unit wise detailed content

Unit-1	**Number of lectures = 8**	

Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning).
Open Source/ Free/ Trial Tools: nmap, zenmap, Port Scanners, Network scanners.

Unit – 2	**Number of lectures = 12**	

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.
Hash Values Calculations MD5, SHA1, SHA256, SHA 512, Steganography (Stools)

Unit – 3	**Number of lectures = 12**	
Introduction to System Security, Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation. Open Source/ Free/ Trial Tools: DOS Attacks, DDOS attacks, Wireshark, Cain & abel, iptables/ Windows Firewall, snort, suricata, fail2ban		
Unit – 4	**Number of lectures = 10**	
Internet Security, Cloud Computing &Security, Social Network sites security, Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment. Open Source/ Free/ Trial Tools: WinAudit, Zap proxy (OWASP), burp suite, DVWA kit.		

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://www.ignou.ac.in/upload/Announcement/programmedetails.pdf

Books Recommended

Text Books

1. William Stallings, “Cryptography and Network Security”, Pearson Education/PHI, 2006.
2. V.K. Jain, “Cryptography and Network Security”, Khanna Publishing House.
3. Gupta Sarika, “Information and Cyber Security”, Khanna Publishing House, Delhi.
4. Atul Kahate, “Cryptography and Network Security”, McGraw Hill.
5. V.K. Pachghare, “Cryptography and Information Security”, PHI Learning

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Cyber Security Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">• Basic knowledge of Computers
· Basic knowledge of networking and Internet
· Hands on Windows operating system</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">The course has been designed to give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains.The course aims at providing students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.</td></tr>
<tr><td colspan="8">9. Learning objectives:
The course will help students to gauge understanding in essential techniques in protecting Information Systems, IT infrastructure, analysing and monitoring potential threats and attacks, devising security architecture and implementing security solutions. The students will also have a wider perspective to information security from national security perspective from both technology and legal perspective.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After completion of this course, the students should be able to:
1. Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
2. Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios
3. Identify common trade-offs and compromises that are made in the design and development process of Information Systems
4. Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
<tr><td colspan="8">1. Implementation to gather information from any PC’s connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wireshark/ network sniffers
5. Implementation of Windows security using firewall and other tools
6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other information’s.
9. Implementation of Mobile Audit and generate the report of the existing Artiacts.</td></tr>
</table>

10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery
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://www.ignou.ac.in/upload/Announcement/programmedetails.pdf

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Data Mining</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">· Programming for Problem Solving
· Probability</td><td>6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">Data mining is study of algorithms for finding patterns in large data sets. It is an integral part of modern industry, where data from its operations and customers are mined for gaining business insight. It is also important in modern scientific endeavours. Data mining is an interdisciplinary topic involving, databases, machine learning and algorithms. The course will cover the fundamentals of data mining. It will explain the basic algorithms like data pre-processing, association rules, classification, clustering, sequence mining and visualization. It will also explain implementations in open-source software. Finally, case studies on industrial problems will be demonstrated.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To introduce students to the basic concepts and techniques of Data Mining
2. To develop skills of using recent data mining software for solving practical problems.
3. To gain experience of doing independent study and research.
4. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems
5. Develop and apply critical thinking, problem-solving, and decision-making skills</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After completion of this course, the students should be able to:
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
5. Set up a data mining process for an application, including data preparation, modelling and evaluation
6. Demonstrate knowledge of the ethical considerations involved in data mining.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 12</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction to Data Mining, Understanding Data, Relations to Database, Statistics, Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK; Visualizing Data: Bar Charts, Line Charts, Scatterplots; Working with data: Reading Files,</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Association Rule Mining, Level-wise Method, FP-Tree Method, Other Variants Classification, Decision Tree Algorithm, CART, PUBLIC, Pruning Classification Tree</td></tr>
</table>

Unit – 3	**Number of lectures = 12**	
Clustering Techniques, Clustering of Numeric Data, of Ordinal Data, Efficiency of Clustering, Consensus Clustering, Spectral Clustering		
Unit – 4	**Number of lectures = 8**	
Rough Set Theory and its Application to Data Mining, 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 Resources:

https://nptel.ac.in/courses/106105174

Books Recommended

Text Books

1. Data Mining Techniques (4e) Universities Press Arun K Pujari
2. Kamber and Han, “Data Mining Concepts and Techniques”, Hartcourt India P. Ltd
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Data Mining 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 for Problem Solving · Probability	**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

Data mining is study of algorithms for finding patterns in large data sets. It is an integral part of modern industry, where data from its operations and customers are mined for gaining business insight. It is also important in modern scientific endeavours. Data mining is an interdisciplinary topic involving, databases, machine learning and algorithms. The course will cover the fundamentals of data mining. It will explain the basic algorithms like data pre-processing, association rules, classification, clustering, sequence mining and visualization. It will also explain implementations in open-source software. Finally, case studies on industrial problems will be demonstrated.

9. Learning objectives:

1. To introduce students to the basic concepts and techniques of Data Mining
2. To develop skills of using recent data mining software for solving practical problems.
3. To gain experience of doing independent study and research.
4. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems
5. Develop and apply critical thinking, problem-solving, and decision-making skills

10. Course Outcomes (COs):

After completion of this course, the students should be able to:

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
5. Set up a data mining process for an application, including data preparation, modelling and evaluation
6. Demonstrate knowledge of the ethical considerations involved in data mining.

List of Experiments (Indicative)

1. Demonstration of data pre-processing on datasets
2. To list all the categorical (or nominal) attributes and the real valued attributes
3. Create a data classification model using decision tree
4. Create a data classification model using Naive Bayes
5. Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm
6. Demonstration of Association rule process on dataset test.arff using apriori algorithm

7. Create a data classification model using neural networks.

8. Create a data classification model

9. Demonstrate the working of k-means algorithm for clustering the data.

10. Create a clustering model using hierarchical clustering 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:

https://nptel.ac.in/courses/106105174

<table>
<tr><td colspan="8">1. Name of the Department: Computer Science & Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Design Thinking</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ( )</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical</td></tr>
<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">7. Brief Syllabus
This gives an overview of the design thinking process. It is a hands on course where students will develop a physical or digital prototype of a product to solve a problem. All presentations should be</td></tr>
<tr><td colspan="8">8. Learning objectives:
1. Recognize the importance of DT
2. Explain the phases in the DT process
3. Learn steps required to complete each phase in DT process
4. Apply each phase in the DT process
5. Use storytelling in presenting ideas and prototypes</td></tr>
<tr><td colspan="8">9. Course Outcomes (COs):
1 Recognize the importance of Design Thinking
2 Identify the steps in the DT process
3 Recognize the steps in the empathize phase of DT
4 Identify the steps required to conduct an immersion activity
5 Conduct an immersion activity and fill up the DT question template
6 Recognize the steps to create personas in the define phase of DT
7 Create personas in the define phase of DT
8 Recognize the steps to create problem statements in the define phase of DT
9 Define the problem statements in the define phase of DT
10 Recognize the steps in the ideate phase of DT
11 Apply the steps in the ideate phase of DT
12 Recognize how doodling can help to express ideas
13 Recognize the importance storytelling in presenting ideas and prototypes
14 Recognize the importance of the prototype phase in DT
15 Create a prototype
16 Recognize the importance of service value proposition
17 Create a value proposition statement
18 Recognize the best practices of the testing phase in DT
19 Test a prototype created through a DT process</td></tr>
<tr><td colspan="8">10. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2"></td><td colspan="4">Introduction to DT</td></tr>
<tr><td colspan="8">What is DT? Why is it important for businesses? What is the 5-step Stanford model?</td></tr>
<tr><td colspan="2">Unit - 2</td><td colspan="2"></td><td colspan="4">Empathy Phases</td></tr>
</table>

Describe the empathy phase, empathy maps, user persona and immersion exercise.

Unit - 3		**Ideation**

Describe various ideation techniques and practice exercises

Unit - 4		**Prototype Development and Testing**

Tools and techniques for developing paper and digital prototypes and test them

11. Lab Component

1. Make a presentation about a product they like or disliked based on their experience. What would they need in a bad product to make it good?
2. Empathy exercise 1. We met; 2. We were amazed to realize that; 3. We wonder if this means 4. It would change the world if
3. Immersion exercise
4. Develop user persona
5. Develop problem statement
6. Brainstorming exercise
7. Brain dumping and exercise
8. Mind mapping and doodling exercise
9. Prototype development
10. Prototype testing
11. Value proposition development
12. Project 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/

Online Resources:

https://www.coursera.org/learn/uva-darden-design-thinking-innovation
https://www.coursera.org/professional-certificates/google-ux-design
https://www.coursera.org/learn/creative-thinking-techniques-and-tools-for-success
https://www.coursera.org/projects/create-empathy-map-miro
https://www.coursera.org/learn/creative-design-prototyping-testing

13. Books Recommended

1 Creative Confidence by Tom Kelley and Davis Kelley
2 The Art of Creative Thinking by Rod Judkins
3 Change by Design by Tim Brown
4 Design Thinking playbook by Michael Lewrick, Patrick Link, and Larry Leifer

Semester – VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Summer Internship-III	-	-	-	2
TOTAL			**6**	**0**	**20**	**18**

Program Electives - III

12. Name of the Department- Computer Science Engineering						
13. Course Name	**Data Analytics**	**L**	**T**		**P**	
14. Course Code		**3**	**0**		**0**	
15. Type of Course (use tick mark)		**Core ()**	**PE ( )**		**OE ()**	
16. Pre-requisite (if any)	**Data Mining and Statistics**	**17. Frequency (use tick marks)**	Even ()	Odd ( )	Either Sem ()	Every Sem ()
18. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 40		**Tutorials = 0**	**Practical = 0**			

19. Course Description

This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to make decisions on operations, risk management, finance, marketing, etc. Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners.

20. Learning objectives:

It also focuses on the "technologies", i.e., the tools/algorithms that are available for storage and processing of Big Data. It also helps a student to perform a variety of "analytics" on different data sets and to arrive at positive conclusions.

21. Course Outcomes (COs):

1. This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to support decision making.
2. To gather sufficient relevant data, conduct data analytics using scientific methods, and understand appropriate connections between quantitative analysis and real - world problems.
3. Understand the exact scopes and possible limitations of each method to provide constructive guidance in decision making.
4. To Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
5. To make better decisions by using advanced techniques in data analytics.

Unit wise detailed content

Unit-1	**Number of lectures = 8**	

Data Definitions and Analysis Techniques: Elements, Variables, and Data Categorization, Levels of Measurement, Data Management and Indexing Descriptive Statistics: Measures of Central Tendency, Measures of Location of Dispersions, Error Estimation and Presentation (Standard Deviation, Variance), Introduction to Probability

Unit – 2	**Number of lectures = 12**	

Basic Analysis Techniques: Statistical Hypothesis Generation and Testing, Chi-Square Test, T -Test, Analysis of Variance, Correlation Analysis, Maximum Likelihood Test

Unit – 3	**Number of lectures = 12**	

Data Analysis Techniques-I: Regression Analysis, Classification Techniques, Clustering Techniques (K-Means, K-Nearest Neighborhood)		
Unit – 4	**Number of lectures = 8**	
Introduction to R Programming: Introduction to R Software Tool, Statistical Computations using R (Mean, Standard Deviation, Variance, Regression, Correlation etc.)		

22. 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/110106064

https://nptel.ac.in/courses/106107220

Books Recommended

Text Books

1. Probability and statistics for Engineers and Scientists (9 Edn.), Ronald E Walppole, Raymond H Myres, Sharon L. Myres and Leying Ye, Prentice Hall Inc
2. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.) Travor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014
3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Data Analytics 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)	**Data Mining and 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

This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to make decisions on operations, risk management, finance, marketing, etc. Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners.

9. Learning objectives:

It also focuses on the "technologies", i.e., the tools/algorithms that are available for storage and processing of Big Data. It also helps a student to perform a variety of "analytics" on different data sets and to arrive at positive conclusions.

10. Course Outcomes (COs):

1. This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to support decision making.
2. To gather sufficient relevant data, conduct data analytics using scientific methods, and understand appropriate connections between quantitative analysis and real - world problems.
3. Understand the exact scopes and possible limitations of each method to provide constructive guidance in decision making.
4. To Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
5. To make better decisions by using advanced techniques in data analytics.

List of Experiments (Indicative)

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

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/110106064

https://nptel.ac.in/courses/106107220

Books Recommended

Text Books

4. Probability and statistics for Engineers and Scientists (9 Edn.), Ronald E Walppole, Raymond H Myres, Sharon L. Myres and Leying Ye, Prentice Hall Inc
5. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.) Travor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014
6. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

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)	• Sensors, System Integration · Cloud and Network Security	**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

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices

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-life IoT based projects.

10. Course Outcomes (COs):

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

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects

Unit wise detailed content

Unit-1	**Number of lectures = 7**	

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

Unit – 2	**Number of lectures = 8**	

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Unit – 3	**Number of lectures = 15**	

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

Unit – 4	**Number of lectures = 10**	

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

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/106105166

Books Recommended

Text Books

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, “A Hands on Approach”, University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
4. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi
5. Adrian McEwen, “Designing the Internet of Things”, Wiley

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Internet of Things Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">● Sensors, System Integration
· Cloud and Network Security</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()
Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices</td></tr>
<tr><td colspan="8">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-life IoT based projects.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After the completion of this course, the students will be able to:
1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
<tr><td colspan="8">1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when ‘1’/’0’ is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from</td></tr>
</table>

thingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

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/106105166

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Virtual Reality**	**L**	**T**		**P**	
3. Course Code		**3**	**0**		**0**	
4. Type of Course (use tick mark)		**Core ()**	**PE ( )**		**OE ()**	
5. Pre-requisite (if any)	**Fundamentals of Programming**	**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 introduce you to Virtual Reality (VR). The course will teach you everything from the basics of VR- the hardware and the history of VR- to different applications of VR, the psychology of Virtual Reality, and the challenges of the medium.

9. Learning objectives:

The objective of this course is to provide a detailed understanding of the concepts of Virtual Reality and its applications.

10. Course Outcomes (COs):

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

1. Understand geometric modelling and Virtual environment.
2. Study about Virtual Hardware and Software
3. Develop Virtual Reality applications.

Unit wise detailed content

Unit-1	**Number of lectures = 7**	

Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image

Unit – 2	**Number of lectures = 8**	

Geometric Modelling: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection

Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems

Unit – 3	**Number of lectures = 15**	

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system.

Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Unit – 4	**Number of lectures = 10**	

Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

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

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

Online Resources:

https://www.coursera.org/learn/introduction-virtual-reality

https://nptel.ac.in/courses/106106138

Books Recommended

Text Books

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.
6. www.vresources.org

7. www.vrac.iastate.edu

8. www.w3.org/MarkUp/VRM

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Virtual Reality Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Fundamentals of Programming</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">This course will introduce you to Virtual Reality (VR). The course will teach you everything from the basics of VR- the hardware and the history of VR- to different applications of VR, the psychology of Virtual Reality, and the challenges of the medium.</td></tr>
<tr><td colspan="8">9. Learning objectives:
The objective of this course is to provide a detailed understanding of the concepts of Virtual Reality and its applications.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">At the end of the course, the students will be able to:
1. Understand geometric modelling and Virtual environment.
2. Study about Virtual Hardware and Software
3. Develop Virtual Reality applications.</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
<tr><td colspan="8">1. Developing architecture of a house using Virtual Reality.
2. Perform CRO based experiment using Virtual Reality.
3. Undertaking qualitative analysis in Chemistry using Virtual Reality.
4. Carry out assembly/disassembly of an engine using Virtual Reality.
5. Explore human anatomy using Virtual Reality.
6. Simulation of circulation of blood in heart.
7. Simulation of Fight/Vehicle/Space Station.
8. Building Electronic circuit using Virtual Reality, given basic electronic components.
9. Developing concept of Virtual class room with multiplayer.</td></tr>
<tr><td colspan="8">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/

<u>Online Resources:</u>

https://www.coursera.org/learn/introduction-virtual-reality

https://nptel.ac.in/courses/106106138</td></tr>
</table>

PROGRAM ELECTIVE – IV

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Blockchains</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">• Cryptography Techniques
• Data Structures and Algorithms
• Introduction to Programming</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">This course of the Blockchain specialization provides a broad overview of the essential concepts of blockchain technology – by initially exploring the Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.</td></tr>
<tr><td colspan="8">9. Learning objectives:
The objective of this course is to provide conceptual understanding of how block chain technology can be used to innovate and improve business processes. The course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using block Chain technology.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">At the end of this course, the students will be able to:
1. Understand block chain technology.
2. Develop block chain-based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks.
3. Build and deploy block chain application for on premise and cloud-based architecture.
4. Integrate ideas from various domains and implement them using block chain technology in different perspectives</td></tr>
<tr><td colspan="8">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.</td></tr>
</table>

Working with Consensus in Bitcoin**:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Unit – 3	**Number of lectures = 12**	

Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

Unit – 4	**Number of lectures = 10**	

Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

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

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

Online Resources:

https://nptel.ac.in/courses/106104220

https://www.coursera.org/learn/blockchain-basics

Books Recommended

Text Books

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”
3. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Blockchains Lab</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">• Cryptography Techniques
• Data Structures and Algorithms
• Introduction to Programming</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">This course of the Blockchain specialization provides a broad overview of the essential concepts of blockchain technology – by initially exploring the Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.</td></tr>
<tr><td colspan="8">9. Learning objectives:
The objective of this course is to provide conceptual understanding of how block chain technology can be used to innovate and improve business processes. The course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using block Chain technology.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">At the end of this course, the students will be able to:
1. Understand block chain technology.
2. Develop block chain-based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks.
3. Build and deploy block chain application for on premise and cloud-based architecture.
4. Integrate ideas from various domains and implement them using block chain technology in different perspectives</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
<tr><td colspan="8">1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run.
https://github.com/hyperledger/
https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block chain/index.html
https://console.bluemix.net/docs/containers/container_index.html#container_index
2. Create and deploy a block chain network using Hyperledger Fabric SDK for Java
Set up and initialize the channel, install and instantiate chaincode, and perform invoke and query on your block chain network
(https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using-fabric-sdk-java/)
3. Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules
(https://developer.ibm.com/patterns/interacting-with-a-block chain-network/)
4. Deploy an asset-transfer app using block chain. Learn app development within a</td></tr>
</table>

Hyperledger Fabric network
(https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/)
5. Use block chain to track fitness club rewards
Build a web app that uses Hyperledger Fabric to track and trace member rewards
(https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/)
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Block chain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing results and data in the starter plan
(https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/)
7. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED
(https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block chain/)
8. Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market
(https://developer.ibm.com/patterns/securing-art-using-block chain-digital-certificates/)
9. Mini projects such as :
(i) Block chain for telecom roaming, fraud, and overage management. See how communication service providers use block chain to enhance their value chains.
https://developer.ibm.com/patterns/block chain-for-telecom-roaming-fraud-and-overagemanagement/
(ii) Use IoT dashboards to analyze data sent from a Block chain network. Build an IoT app and IoT dashboards with Watson IoT Platform and Node-RED to analyze IoT data sent from a Block chain network
https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block chain-network/)
(iii) Create an Android app with Block chain integration. Build a Block chain enabled health and fitness app with Android and Kubernetes
https://developer.ibm.com/patterns/create-an-android-app-with-block chain-integration/
(iv) Create a global finance block chain application with IBM Block chain Platform Extension for VS Code. Develop a Node.js smart contract and web app for a Global Finance with block chain use case
https://developer.ibm.com/patterns/global-financing-use-case-for-block chain/
(v) Develop a voting application using Hyperledger and Ethereum. Build a decentralized app that combines Ethereum's Web3 and Solidity smart contracts with Hyperledger's hosting Fabric and Chaincode EVM
https://developer.ibm.com/patterns/voting-app-hyperledger-ethereum/
(vi) Create a block chain app for loyalty points with Hyperledger Fabric Ethereum Virtual Machine. Deploy Fabric locally with EVM and create a proxy for interacting with a smart contract through a Node.js web app
https://developer.ibm.com/patterns/loyalty-points-fabric-evm/

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

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

Online Resources:

https://nptel.ac.in/courses/106104220

https://www.coursera.org/learn/blockchain-basics

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Natural Language Processing</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="4">4. Type of Course (use tick mark)</td><td colspan="2">Core ()</td><td colspan="2">PE ( )</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">• Cryptography Techniques
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<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="3">Tutorials = 0</td><td colspan="3">Practical = 0</td></tr>
<tr><td colspan="9">8. Course Description</td></tr>
<tr><td colspan="9">Natural Language Processing (NLP) is a rapidly developing field with broad applicability throughout the hard sciences, social sciences, and the humanities. The ability to harness, employ and analyze linguistic and textual data effectively is a highly desirable skill for academic work, in government, and throughout the private sector. This course is intended as a theoretical and methodological introduction to a the most widely used and effective current techniques, strategies and toolkits for natural language processing, with a primary focus on those available in the Python programming language</td></tr>
<tr><td colspan="9">9. Learning objectives:
a. Explain the concepts of artificial intelligence to solve problems.
b. Appraise the concept of natural languages processing components using NLP tools.
c. Create scalable applications that can robustly handle errors in runtime applications.
d. Designing applications using pre-built NLP processor.</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">At the end of this course, the students will be able to:
1. Understand approaches to syntax and semantics in NLP.

2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

3. Understand current methods for statistical approaches to machine translation.

4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP</td></tr>
<tr><td colspan="9">Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
</table>

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

Unit – 2	**Number of lectures = 10**	

Introduction to semantics and knowledge representation, Some applications like machine translation, database interface. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

Unit – 3	**Number of lectures = 10**	

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

Unit – 4	**Number of lectures = 10**	

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

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

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

Online Resources:

https://nptel.ac.in/courses/106105158

Books Recommended

Text Books

1. Natural Language Understanding, Allen, Pearson Education.
2. Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, D. Jurafsky & J. H. Martin, Pearson Education.
3. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich SchutzeMIT Press.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Natural Language Processing Lab</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">0</td><td colspan="2">0</td><td>4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">• Cryptography Techniques
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<tr><td colspan="3">Lectures = 0</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 24</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">Natural Language Processing (NLP) is a rapidly developing field with broad applicability throughout the hard sciences, social sciences, and the humanities. The ability to harness, employ and analyze linguistic and textual data effectively is a highly desirable skill for academic work, in government, and throughout the private sector. This course is intended as a theoretical and methodological introduction to a the most widely used and effective current techniques, strategies and toolkits for natural language processing, with a primary focus on those available in the Python programming language</td></tr>
<tr><td colspan="8">9. Learning objectives:
e. Explain the concepts of artificial intelligence to solve problems.
f. Appraise the concept of natural languages processing components using NLP tools.
g. Create scalable applications that can robustly handle errors in runtime applications.
h. Designing applications using pre-built NLP processor.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">At the end of this course, the students will be able to:
1. Understand approaches to syntax and semantics in NLP.

2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

3. Understand current methods for statistical approaches to machine translation.

4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP</td></tr>
<tr><td colspan="8">List of Experiments (Indicative)</td></tr>
</table>

1. To learn about morphological features of a word by analysing it. (Word Analysis)

2. To generate word forms from root and suffix information. (Word Generation)

3. Understanding the morphology of a word by the use of Add-Delete table (Morpgology)

4. To learn to calculate bigrams from a given corpus and calculate probability of a sentence. (N-Grams)

5. To learn how to apply add-one smoothing on sparse bigram table. (N-Gram Smoothing)

6. To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model. (POS Tagging – Hidden Markov Model)

7. To find POS tags of words in a sentence using Viterbi decoding. (POS Tagging – Viterbi Decoding).

8. To know the importance of context and size of training corpus in learning Parts of Speech. (Building POS Tagger).

9. To understand the concept of chunking and get familiar with the basic chunk tagset. (Chunking).

10. To know the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking. (Building Chunker)

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/106105158

<table>
<tr><td colspan="7">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>2. Course Name</td><td colspan="2">Soft Computing</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td>3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">0</td></tr>
<tr><td colspan="2">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE ( )</td><td colspan="2">OE ()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td colspan="2">• Cryptography Techniques
• Data Structures and Algorithms
• Introduction to Programming</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="7">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="2">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="7">8. Course Description</td></tr>
<tr><td colspan="7">This course introduces soft computing methods which, unlike hard computing, are tolerant of imprecision, uncertainty and partial truth. The principal constituents of soft computing are fuzzy logic, neural network theory, and probabilistic reasoning.</td></tr>
<tr><td colspan="7">9. Learning objectives:
a. Learn soft computing techniques and their applications.
b. Analyze various neural network architectures.
c. Define the fuzzy systems.
d. Understand the genetic algorithms</td></tr>
<tr><td colspan="7">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="7">At the end of this course, the students will be able to:
1. Recognize the feasibility of applying a soft computing methodology for a particular problem. 2. Understand the concepts and techniques of soft computing and foster their abilities in designing and implementing soft computing-based solutions for real-world and engineering problems.
3. Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
5. Apply genetic algorithms to combinatorial optimization problems.</td></tr>
<tr><td colspan="7">Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="7">Neural Networks (Back propagation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
</table>

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.		
Unit – 3	**Number of lectures = 10**	
Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications		
Unit – 4	**Number of lectures = 10**	
Genetic Algorithm (GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.		

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/106105173

Books Recommended

Text Books

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

2. N. P. Padhy, "Artificial Intelligence and Intelligent Systems” Oxford University Press. Reference Books:

3. Siman Haykin, "Neural Netowrks”, Pearson Education

4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India. 5. Kumar Satish, “Neural Networks” McGraw Hill

1. Name of the Department- Computer Science Engineering						
2. Course Name	**Soft Computing 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)	• Cryptography Techniques • Data Structures and Algorithms • Introduction to Programming	**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 soft computing methods which, unlike hard computing, are tolerant of imprecision, uncertainty and partial truth. The principal constituents of soft computing are fuzzy logic, neural network theory, and probabilistic reasoning.

9. Learning objectives:

e. Learn soft computing techniques and their applications.

f. Analyze various neural network architectures.

g. Define the fuzzy systems.

h. Understand the genetic algorithms

10. Course Outcomes (COs):

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

1. Recognize the feasibility of applying a soft computing methodology for a particular problem. 2. Understand the concepts and techniques of soft computing and foster their abilities in designing and implementing soft computing-based solutions for real-world and engineering problems.

3. Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem

4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

5. Apply genetic algorithms to combinatorial optimization problems.

List of Experiments (Indicative)

1. Create a perceptron with appropriate no. of inputs and outputs. Train using fixed increment learning algorithm until no change in weights is required. Output the final weights.

2. Create a simple ADALINE network with appropriate no. of input and output nodes. Train using delta learning rule until no change in weights is required. Output the final weights.

3 Write a program to implement artificial neural network without back propagation.

4. Write a program to implement artificial neural network with back propagation.

5 Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

6 Implement travelling sales person problem (tsp) using genetic algorithms.

7 Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data. 8 Implement crisp partitions for real-life iris dataset

9 Write a program to implement Hebb's rule Write a program to implement Delta rule.

10 Write a program to implement logic gates

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/106105173

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">PROJECT</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>12</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 12 hr/week</td></tr>
</table>

8. Course Description

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the chosen/given project, applying the theoretical knowledge to a real-life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision-making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

9. Learning objectives:

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

10. Course Outcomes (COs):

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

1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.
2. Use the relevant tools necessary for engineering practice.
3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.
4. Communicate effectively and learn to be a team player.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Summer Internship - III</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ( )</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd ( )</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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</td></tr>
</table>

Semester VIII

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.

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

B.Tech (Computer Science & Engineering) with minors in Artificial Intelligence and Machine Learning

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-I	3	1	-	4
2		Web Development	3	-	-	3
3		Basics of Electrical & Electronics Engineering	3	-	-	3
4		Programming for Problem Solving	3	-	-	3
5		AECC -1*	2	-	-	2
6		VAC – 1**	2	-	-	2
7		Programming for Problem Solving Lab	-	-	4	2
8		Web Development Lab	-	-	2	1
9		Python Programming Lab	-	-	2	1
10		Basics of Electrical & Electronics Engineering Lab	-	-	2	1
11		Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain	3	-	-	3
12		Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain Lab	-	-	2	1
TOTAL			**19**	**1**	**12**	**26**

Semester – I

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Introduction to AI , Machine Learning, Data Science, Cybersecurity, Blockchain</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td>PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students the concepts of AI, Machine Learning, Data Science, Cybersecurity, Blockchain</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. Understand what is AI
2. What is Machine Learning
3. What is Data Science
4. What is Blockchain
5. Data Analytics</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) Understand the key concepts of Artificial Intelligence and Machine Learning</td></tr>
<tr><td colspan="8">b) The technology Data Science</td></tr>
<tr><td colspan="8">c) How Blockchain Works</td></tr>
<tr><td colspan="8">d) Cybersecurity</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Introduction to Machine Learning</td></tr>
<tr><td colspan="8">What is Machine Learning, Learning from Data, History of Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Introduction to Data Science</td></tr>
<tr><td colspan="8">Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machinegenerated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, Distributed file systems, Distributed programming framework, data integration</td></tr>
</table>

framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments

Unit – 3	**Number of lectures = 10**	Introduction to Blockchain and Introduction to Cybersecurity

What Is Blockchain?, The Simple Definition, Bitcoin: The "Big Bang" of Blockchain, How Bitcoin Works, The Decentralized Ledger, Blockchain Is a Platform, Blockchain Building Blocks, Nodes and Miners, Free, Instant, Scalable, Trusted, Regulation: Evolution versus Revolution

Threat Landscape, Cybersecurity and information, Cyber resilience, Implement Cyber Security, Making Trade Offs, three security pillers, anatomy of threats, technical threats, human threats, physical threats, third-party threats

Unit – 4	**Number of lectures = 10**	Introduction to Data Analytics

Working with Formula and Functions, Introduction to Charts, Logical functions using Excel, Analysing Data with Excel.

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

Artificial Intelligence | Third Edition | By Pearson: A Modern Approach Paperback by Russell, Pearson Education India; 3rd edition (1 January 2015), ISBN 9789332543515

Artificial Intelligence: Concepts and Applications Paperback by Lavika Goel, Wiley (1 January 2021), ISBN 8126519932

Data Science: The Ultimate Guide to Data Analytics, Data Mining, Data Warehousing, Data Visualization, Regression Analysis, Database Querying, Big Data for Business and Machine Learning for Beginners by Herbert Jones, Bravex Publications (10 January 2020), ISBN-10 : 1647483042

Cyber Security by Nina Godbole (Author), Sunit Belapure (Author), Wiley (1 January 2011), ISBN 9788126521791

Bitcoin and Blockchain for Beginners, by Ollie Ruell Ruell, Ollie Ruell (4 April 2022), ISBN 3986534032

Semester – II

S.No.	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-II	3	1	-	4
2		Web Programming with Python and Java Script	3	-	-	3
3		Engineering Workshop Lab	1	-	4	3
4		AECC - 2*	2	-	-	2
5		VAC – 2**	2	-	-	2
6		Web Programming with Python and Java Script Lab	-	-	2	1
7		Data Analysis using Python	3	-	-	3
8		Data Analysis using Python Lab	-	-	2	1
TOTAL			**14**	**1**	**08**	**19**

Semester – II

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Data Analysis using Python</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students the concepts of Python</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. Python Programming
2. NumPy: Array and vectorized computation
3. Pandas
4. Matplotlib, Seaborn</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) Basics of Python Programming</td></tr>
<tr><td colspan="8">b) Concepts of Numpy</td></tr>
<tr><td colspan="8">c) Concepts of Pandas</td></tr>
<tr><td colspan="8">d) Visualization with Matplotlib, Seaborn</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Python programming Basic, Data Structure, functions, and files</td></tr>
<tr><td colspan="8">Python interpreter, IPython Basics, Tab completion, Introspection, %run command, magic commands, matplotlib integration, python programming, language semantics, scalar types. Control flow.

Tuple, list, built-in sequence function, dict, set, functions, namescape, scope, local function, returning multiple values, functions are objects, lambda functions, error and exception handling, file and operation systems.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5">NumPy: (Array and vectorized computation)</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Pandas</td></tr>
</table>

Pandas data structure, series, DataFrame, 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 = 10**	**Visualization with Matplotlib, Plotting with pandas and seaborn:**
Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data.		
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 Problem Solving and Python Programming: Fundamentals and Applications: NumPy, Pandas and Matplotlib Paperback by Harsh Bhasin, New Age International Private Limited; First edition (1 August 2021); ISBN 8195175503 Python programming crash course by Tony F Charles (Author), Tony F. Charles (18 October 2020), ISBN-10 1801116024		

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Probabilistic Modelling and Reasoning with Python	3	-	-	3
11		Probabilistic Modelling and Reasoning with Python Lab	-	-	2	1
12		Summer Internship-I	-	-	-	1
TOTAL			**21**	**-**	**10**	**27**

Semester III

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science & Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Probabilistic Modelling and Reasoning with Python</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain; Data Analysis with Python</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
</table>

8. Course Description:

The course begins with the theoretical study of statistics and probability distributions which is widely used in ML, AI and all engineering applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, and confidence intervals.

9. Course Objectives:

The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.

10. Course Outcomes:

On completion of this course, the students are expected to learn

1. Basics of Statistics and Probability distributions
2. Sampling theory and Theory of Estimation
3. Various tests of Hypothesis and Significance
4. Correlation and Regression and fitting of different types of curves.

11. Unit Wise Detailed Content

UNIT – I (8 Lectures)

Introduction to Statistics: Introduction to Statistics. Role of statistics in scientific methods, current applications of statistics.

Scientific data gathering: Sampling techniques, scientific studies, observational studies, data management.

Data description: Displaying data on a single variable (graphical methods, measure of central tendency, measure of spread), displaying relationship between two or more variables, measure of association between two or more variables.

UNIT – II (8 Lectures)

Probability Theory: Sample space and events, probability, axioms of probability, independent events, conditional probability, Bayes' theorem.

Random Variables: Discrete and continuous random variables. Probability distribution of discrete random variables, binomial distribution, Poisson distribution. Probability distribution of continuous random variables, The uniform distribution, normal (gaussian) distribution, exponential distribution, gamma distribution, beta distribution, t-distribution, χ^2 distribution. Expectations, variance and covariance. Probability Inequalities. Bivariate distributions

UNIT -III (8 Lectures)

Point Estimations: Methods of finding estimators, method of moments, maximum likelihood estimators, Bayes estimators. Methods of evaluating estimators, mean squared error, best unbiased estimator, sufficiency and unbiasedness

Interval Estimations: Confidence interval of means and proportions, Distribution free confidence interval of percentiles

UNIT – IV (8 Lectures)

Test of Statistical Hypothesis and p-values: Tests about one mean, tests of equality of two means, test about proportions, p-values, likelihood ratio test, Bayesian tests

Bayesian Statistics: Bayesian inference of discrete random variable, Bayesian inference of binomial proportion, comparing Bayesian and frequentist inferences of proportion, comparing Bayesian and frequentist inferences of mean

UNIT- V (8Lectures)

Univariate Statistics using Python: Mean, Mode. Median, Variance, Standard Deviation, Normal Distribution, t-distribution, interval estimation, Hypothesis Testing, Pearson correlation test, ANOVA F-test

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. Recommended Books:

- Achim Klenke, (2014), Probability Theory A Comprehensive Course Second Edition, Springer, ISBN 978-1-4471-5360-3
- Christian Heumann, Michael Schomaker Shalabh (2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer International Publishing, ISBN 978-3-319-46160-1
- Douglas C. Montgomery, (2012), Applied Statistics and Probability for Engineers, 5th Edition, , Wiley India, ISBN: 978-8-126-53719-8.

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2[#]	4	-	-	4
6		VAC – 4[**]	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
9		R Programming	3	-	-	3
10		R Programming Lab	-	-	2	1
TOTAL			**21**	**2**	**8**	**27**

Semester IV

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science & Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>R Programming</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
</table>

8. Course Description:

The course begins with the theoretical study of statistics and probability distributions which is widely used in ML, AI and all engineering applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, and confidence intervals.

9. Course Objectives:

The objective of this course is to teach students R Programming Language, basic functions in R programming language and critical techniques.

10. Course Outcomes:

On completion of this course, the students are expected to learn

1. Basics of Statistics and Probability distributions
2. Sampling theory and Theory of Estimation
3. Various tests of Hypothesis and Significance
4. Correlation and Regression and fitting of different types of curves.

11. Unit Wise Detailed Content

UNIT – I (10 Lectures)

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 – II (10 Lectures)

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 – III (10 Lectures)

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 – IV (10 Lectures)

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/

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3[#]	4	-	-	4
6		AECC – 3[*]	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Machine Learning and Pattern Recognition	3	-	-	3
10		Machine Learning and Pattern Recognition Lab	-	-	2	1
11		Summer Internship-II	-	-	-	1
TOTAL			**21**	**1**	**6**	**26**

Semester V

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science & Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Machine Learning and Pattern Recognition</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain; Data Analysis with Python; Probabilistic Modelling and Reasoning with Python;</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 42</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description
The course begins with the key concepts of Machine Learning. The student gets an opportunity to learn Machine learning algorithms, analyse the results, and techniques to optimize them.</td></tr>
<tr><td colspan="8">9. Course Objectives:
The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning</td></tr>
<tr><td colspan="8">10. Course Outcomes:
On completion of this course, the students are expected to learn
1. Basic Algorithms of Machine Learning
2. Supervised and Unsupervised Learning
3. Linear Regression, Classification, Tree, PCA, SVD, SVM
4. Resampling Methods and Optimization Techniques</td></tr>
<tr><td colspan="8">11. Unit wise Detailed Content</td></tr>
<tr><td colspan="3">Unit I</td><td>Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction: Learning systems, real world applications of machine learning, why machine learning, variable types and terminology, function approximation</td></tr>
</table>

Types of machine learning: Supervised learning, unsupervised learning, reinforcement learning

Important concepts of machine learning: Parametric vs non-parametric models, the trade-off between prediction accuracy and model interpretability, the curse of dimensionality, measuring the quality of fit, bias-variance trade off, overfitting, model selection, no free lunch theorem

Unit II	**Number of lectures = 12**	

Linear Regression: Linear regression, estimating the coefficients, accessing the accuracy of coefficient estimates, accessing the accuracy of the model, multiple linear regression, qualitative predictors

Classification: Logistic regression, estimating regression coefficients, making predictions, multiple logistic regressions, linear discriminant analysis, bayes' theorem of classification, LDA for p=1, LDA for p>1, quadratic discriminant analysis

Unit III	**Number of lectures = 12**	

Resampling Methods, Model Selection and Regularization: Cross-validation, leave-one-out cross- validation, k-fold cross-validation, the bootstrap, subset selection, shrinkage methods, ridge and lasso regression, dimension reduction methods, principal components regression, partial least square

Tree Based Methods: Advantages and disadvantages of trees, regression Trees, classification trees, bagging, random forest, boosting

Unit IV	**Number of lectures = 12**	

Support Vector Machine: Maximum margin classifier, classification using a separating hyperplane, the maximal margin classifier, support vector classifier, support vector machines, classification with non-linear decision boundaries, support vector machine, one-versus-one classification, one-versus- many classification

Unsupervised Learning: Principle component analysis, what are principal components, clustering methods, k-means clustering, hierarchical clustering, Independent component analysis, latent semantic indexing, Markov Models, Hidden Markov Models

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. Recommended Books

- Machine Learning by Tom M. Mitchell - McGraw Hill Education; First edition
- Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop - Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition
- The Elements of Statistical Learning: Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman - Springer; 2nd ed. 2009, Corr. 9th printing 2017 edition

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
9		Neural Network & Deep Learning	3	-	-	3
10		Neural Network & Deep Learning Lab	-	-	2	1
TOTAL			**18**	**1**	**12**	**26**

Semester VI

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science & Engineering</td></tr>
<tr><td>2. Course Name</td><td>Neural Network & Deep Learning</td><td>L</td><td>T</td><td colspan="4">P</td></tr>
<tr><td>3. Course Code</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain; Data Analysis with Python; Probabilistic Modelling and Reasoning with Python; Machine Learning</td><td>3</td><td>0</td><td colspan="4">2</td></tr>
<tr><td colspan="2">4. Type of Course (use tick mark)</td><td>Core (✓))</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td>Operating System</td><td>6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="2">Lectures = 40</td><td>Tutorials = 0</td><td colspan="5">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description
The course begins with key concepts of neural networks, feed-forward neural network, and backpropagation. The student gets an opportunity to learn the programming languages (TensorFlow) to design the deep learning models. The student learns the concepts behind CNN, RNN, LSTM, Autoencoders, and GANs. The hands-on learning will help build strong knowledge base for designing advanced deep learning models.</td></tr>
<tr><td colspan="8">9. Course Objectives:
The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.</td></tr>
<tr><td colspan="8">10. Course Outcomes:
On completion of this course, the students are expected to learn
1. Neural Network, Feed Forward and Backpropagation
2. TensorFlow and Kera’s
3. RNN, CNN, Autoencoders</td></tr>
<tr><td colspan="8">11. Unit-wise Detailed Content</td></tr>
<tr><td colspan="2">Unit - I</td><td>Number of lectures = 10</td><td colspan="5"></td></tr>
</table>

The neural network: The neuron, linear perceptron, feed-forward neural network, limitations of linear neurons, sigmoid, tanh, relu neurons, softmax output layer, information theory, cross entropy, Kullback-Leibler divergence

Training feed-forward neural network: Gradient Descent, delta rules and learning rates, gradient descent with sigmoidal neurons, the backpropagation algorithms, stochastic and minibatch gradient descent, test sets, validation sets and overfitting, preventing overfitting

Unit -II	**Number of lectures = 10**	

TensorFlow: Computation graphs, graphs, sessions and fetches, constructing and managing graph, flowing tensors, sessions, data types, tensor arrays and shapes, names, variables, placeholders and simple optimization, linear regression and logistic regression using tensorflow

Implement Neural Network: Introduction to Keras, Build neural network using Keras, Evaluating models, data preprocessing, feature engineering, feature learning, overfitting, underfitting, weight regularization, dropout, universal workflow of deep learning

Unit-III	**Number of lectures = 10**	

Moving beyond gradient descent: Local minima vs global minima vs saddle, model identifiability, correcting gradient points in wrong directions, Momentum based optimization, second order methods, learning rate adaption, adagrad, rmsprop, adam

Convolutional Neural Network: Convolution operation, filters and feature maps, motivation, sparse interactions, parameter sharing and equivariant representation, padding and stride, max pooling, full architectural description of convolutional network, build CNN using data augmentation, using pretrained convnet, visualize what convnet learn.

Unit-IV	**Number of lectures = 10**	

Embedding and Representation Learning: Principal component analysis, working with text data, one-hot encoding of words and characters, word embedding, autoencoder architecture, denoising, sparsity, Word2vec framework, Skip-Gram architecture.

Models for Sequence Analysis: Analyzing Variable-length inputs, Seq2seq with neural n-gram, part of speech tagger, dependency parse, syntaxnet, recurrent neural network, challenges with vanishing gradients, long short term memory units

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. Recommended Books:

Text Books:

- Deep Learning with Python by Francois Chollet - Manning Publications; 1 edition
- Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courville, Francis Bach - MIT Press (3 January 2017)

- Tensor Flow for Deep Learning by Reza Zadeh, Bharath Ramsundar - Shroff/O'Reilly; First edition (2018)

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Data Visualization	3	-	-	3
7		Data Visualization Lab	-	-	2	1
8		Summer Internship-III	-	-	-	2
TOTAL			**9**	**0**	**22**	**22**

Semester VII

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science & Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Data Visualization</td><td colspan="2">L-3</td><td colspan="2">T</td><td>P-2</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td colspan="2">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓))</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Introduction to AI, Machine Learning, Data Science, Cybersecurity, Blockchain;</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Rationale:
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.</td></tr>
<tr><td colspan="8">9. Course Objectives:
The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.</td></tr>
<tr><td colspan="8">10. Course Outcomes:
1. Understand the basics of data handling
2. Understand and apply the commonly used function for data analysis.
3. Use of Tableau for data visualization.
4. Building reports from data using Tableau</td></tr>
<tr><td colspan="8">11. Unit-wise Detailed Content</td></tr>
<tr><td colspan="3">Unit - I</td><td colspan="2">Number of lectures = 10</td><td colspan="3">INTRODUCTION TO DATA HANDLING</td></tr>
<tr><td colspan="8">Overview of Data analysis, Introduction to Data visualization, Working with statistical formulas - Logical and financial functions , Data Validation & data models, Power Map for visualize data , Power BI-Business Intelligence , Data Analysis using statistical methods, Dashboard designing.</td></tr>
</table>

Unit -II	**Number of lectures = 10**	**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 , Trendline , Error Bars, Sparklines, 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, Goal Seek, Quadratic Equation , Transportation Problem, Maximum Flow Problem, Sensitivity Analysis, Histogram, Descriptive, Statistics, Anova, F-Test, t-Test, Moving, Average, Exponential Smoothing | Correlation model | Regression model, Practical Lab		
Unit -III	**Number of lectures = 10**	**TABLEAU SOFTWARE: GETTING STARTED WITH TABLEAU SOFTWARE**
What is Tableau? What does the Tableau product suite comprise of? How Does Tableau Work? Tableau Architecture, What is My Tableau Repository? Connecting to Data & Introduction to data source concepts, Understanding the Tableau workspace, Dimensions and Measures, Data Types & Default Properties, Building basic views, Saving and Sharing your work-overview, Practical Lab		
Unit -IV	**Number of lectures = 10**	**TABLEAU: BUILDING VIEWS (REPORTS)**
Date Aggregations and Date parts, Cross tab & Tabular charts, Totals & Subtotals, Bar Charts & Stacked Bars, Trend lines, Forecasting, Filters, Context filters, Line Graphs with Date & Without Date, Tree maps, Scatter Plots		

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. Recommended Books:

Text Books:

- "Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few
- "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky"
- "The Accidental Analyst: Show Your Data Who's Boss" by Eileen and Stephen McDaniel

SEMESTER VIII

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

Total Credits: 189

B.Tech. (Computer Science & Engineering) with minors in Full Stack Development (iOS)

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-I	3	1	-	4
2		Web Development	3	-	-	3
3		Basics of Electrical & Electronics Engineering	3	-	-	3
4		Programming for Problem Solving	3	-	-	3
5		AECC -1*	2	-	-	2
6		VAC – 1**	2	-	-	2
7		Programming for Problem Solving Lab	-	-	4	2
8		Web Development Lab	-	-	2	1
9		Python Programming Lab	-	-	2	1
10		Basics of Electrical & Electronics Engineering Lab	-	-	2	1
11		Basic Architecture of Mac OS X with UID Fundamentals	3	-	-	3
12		Basic Architecture of Mac OS X with UID Fundamentals Lab	-	-	2	1
TOTAL			**19**	**1**	**12**	**26**

<table>
<tr><td colspan="8">Semester - 1</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Basic Architecture of Mac OS X with UID Fundamentals</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 5</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this course, the trainer will train to setup a Mac environment. Basic understanding of design, layout and colour to be applied and its psychology behind User Interface Design.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To be involved with development environment inside the industry.
2. To acquire knowledge of the products.
3. To gain knowledge and practice on design elements and engagement.
4. To refine knowledge and practice on MS Word and Clipart.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. To acquaint students with the practical aspects of Design.
2. To understand the importance of User engagement and Experience.
3. To learn various development techniques</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td>Number of lectures = 7</td><td colspan="5">Desktop & Gestures, Organising Your Application & Productivity Application</td></tr>
</table>

<table>
<tr><td colspan="3">Semester - 1</td></tr>
<tr><td colspan="3">Desktop, Dock, Menu Bar, Primary Click, Secondary Click, Multiple Gestures, Notification Centre, Finder To access Application & Use of Launchpad, Use of spotlight search, Use of Siri, Folders, File Sharing, iWork, iLife, iTunes, Mails, Contacts, Calendar, App Store, Safari.</td></tr>
<tr><td>Unit – 2</td><td>Number of lectures = 7</td><td>System Preferences & Mac OS Security</td></tr>
<tr><td colspan="3">Personal, Hardware, Internet and Wireless, System User, Others Installation, Manage, Trackpad, Manage Gestures, Introduction To Mac OS Security, Enable FileVault, Firmware Password & Application Firewall, Enable SIP - System Integrity Protection, Enable XProtect & MRT - Malware Removal Tool, Keychain Access and Their Uses, Enable iCloud - Backup & Find My Mac, Encrypt External Drives.</td></tr>
<tr><td>Unit – 3</td><td>Number of lectures = 8</td><td>Basics of UI/ UX & Introduction To User Interface and User Experience</td></tr>
<tr><td colspan="3">Basics of Design Fundamentals, Principles fo Design , Introduction to Adobe/ Figma , Layout Making Using Photoshop/ Figma , Project Based on UI/UX, What is UI/UX?, Understanding UI, Principles of UI, Defining a product, Purpose of Design, The Process of Design and It’s Tools .</td></tr>
<tr><td>Unit – 4</td><td>Number of lectures = 8</td><td>Introduction To Design Thinking & Visual Designs</td></tr>
<tr><td colspan="3">What do you mean by Design Thinking?, 5 Stages in the Design Thinking Process, Bad Design vs. Good Design, Personas – A simple Introduction,10 Great Sites for UI Design Patterns/ Apple’s, What is Visual Design?, Elements of Visual Design, Principles of Visual Design, Visual Design Testing Methods.</td></tr>
<tr><td>Unit – 5</td><td>Number of lectures = 10</td><td>Color Theory and Art Of Typography & Layouts and Iconography</td></tr>
<tr><td colspan="3">Principles of Colour Theory, The Colour Wheel, Colour Psychology, Gradients, What is Typography?, The role of Typography & Principles of Typography, What is layout?, Principles of Layout, Grid, What is Iconography?, The role of Iconography, Principles of Iconography, Symbols, Logos and Icons.</td></tr>
</table>

Semester - 1
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: Mac Basics Version 11

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C
1		Engineering Mathematics-II	3	1	-	4
2		Web Programming with Python and Java Script	3	-	-	3
3		Engineering Workshop Lab	1	-	4	3
4		AECC - 2*	2	-	-	2
5		VAC – 2**	2	-	-	2
6		Web Programming with Python and Java Script Lab	-	-	2	1
7		Full Stack Web Development & DevOps	3	-	-	3
8		Full Stack Web Development & DevOps Lab	-	-	2	1
TOTAL			**14**	**1**	**08**	**19**

Semester - 2

1. Name of the Department- Computer Science Engineering						
2. Course Name	Full Stack Web Development & DevOps	**L**	**T**		**P**	
3. Course Code		**3**	**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 = 40		**Tutorials = 0**	**Practical = 5**			

8. Course Description

In this hands-on course, trainer will teach you how to use HTML & CSS and DevOps Concepts. Students will start by learning how to implement different types of operation for making a perfect app or website. With the help of this students will able to create an perfect app or website. You will start by learning how to work with Visual Studio Code software and how to design Websites using HTML & CSS and after this you will be able to know Web Development.

9. Learning objectives:

1. To familiarise with development environment inside the industry.
2. To acquire knowledge and use objective tools in Mac OS.
3. To acquire knowledge and practice on gestures.
4. To acquire knowledge and practice on HTML, CSS and Visual Studio Codes softwares
5. To familiarise with Software Development Life cycle in relation to design

10. Course Outcomes (COs):

1. As the need of hand on practice for the engineers this course has special weightage.
2. To make the students acquainted with the practical aspects of HTML and CSS.
3. To make the students to understand the importance of Web Development using HTML & CSS.
4. To be industry ready a student must have the knowledge of various development techniques and should have knowledge about fundamentals of Web Development.

11. Unit wise detailed content

Semester - 2

Unit-1	**Number of lectures = 5**	**Web Design Principles & Basics in Web Design**
Basic principles involved in developing a web site, Planning process, Five Golden rules of, Web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept, Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards, Audience requirement.		
Unit – 2	**Number of lectures = 7**	**Introduction to HTML & Elements of HTML**
What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags, Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.		
Unit – 3	**Number of lectures = 8**	**Introduction to Cascading Style Sheets & Introduction to Web Publishing or Hosting**
Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs, Creating the Web Site, Saving the site, Working on the web site, Creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.		
Unit – 4	**Number of lectures = 10**	**Introduction to Devops & Cloud Computing**
What Is DevOps, History of DevOps, DevOps definition, DevOps Main Objectives, DevOps and Software Development Life Cycle, Waterfall Model, Agile Model, Continuous Integration & Deployment with Jenkins, Containers and Virtual Development with Docker What is Cloud? Evolution of Cloud Computing, IAAS (Infrastructure as a Service), SAAS (Software as a Service), PAAS (Platform as a Service), Private, Public and Hybrid Cloud, Public Clouds With Amazon Web Services & Google Cloud Services.		
Unit – 5	**Number of lectures = 10**	**Continuous Integration – Jenkins & ANSIBLE & Docker**

Semester - 2

Introduction to Jenkins, Continuous Integration with Jenkins, Configure Jenkins, Jenkins Management, Jenkins Build Pipe Line, Jenkins Master & Slave Node Configuration, Jenkins Workspace Management, Securing Jenkins, Jenkins Plugins, Introduction to Ansible, Ansible Server Configuration, Infrastructure Management, SSH Connection in Ansible Master, YAML Scripts, Host Inventory, Ad-hoc Commands, Docker, How to get Docker Image?, What is Docker Image, Docker Installation, Working with Docker Containers, Docker Command Line Interphase, Docker Compose, Docker Hub, Docker, Trusted Registry, Docker swarm, Docker attach, Docker File & Commands.

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: Website Designs and Techniques.

B.Tech (Computer Science & Engineering)

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		iOS Fundamentals & Swift Programming Language	3	-	-	3
11		iOS Fundamentals & Swift Programming Language Lab	-	-	2	1
12		Summer Internship-I	-	-	-	1
TOTAL			**21**	**-**	**10**	**27**

<table>
<tr><td colspan="8">Semester - 3</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>iOS Fundamentals & Swift Programming Language</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE ()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 5</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this course the trainer will expose students to create and design an application using Xcode. Also the trainer will introduce the iOS architecture to the students which will help students the basic understanding of iOS platform.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To understand various devices in iOS and their uses.
2. To study digital strategy and its impact on the product under observation.
3. To follow the human interface design guidelines laid by iPhone.
4. To understand the concept of Product Visual sensation.
5. To acquire knowledge on Swift Programming.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. The students will learn Swift Programming Language.
2. Understand basis of User Experience.
3. Review data visualisation in every aspect of design
4. Knowledge of various development techniques and fundamentals of Design.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td>Number of lectures = 10</td><td colspan="6">Getting Started With iOS Fundamentals & Introduction To Swift</td></tr>
</table>

Semester - 3		
iOS Introduction, iOS Architecture, Layers in iOS, Core Frameworks, Introduction To The Module, Setting Up Playground, Simple Control Flow		
Unit – 2	**Number of lectures = 10**	**Model View Controller (MVC) In iOS**
Model, Views, Controller, View Controllers, MVC Architecture		
Unit – 3	**Number of lectures = 10**	**Basic Syntax of Swift**
Data Type, Strings, Function Call, Enumeration, Control Flow.		
Unit – 4	**Number of lectures = 10**	**Operators**
Assignment operator, Arithmetic Operator, Remainder Operator, Compound Assignment Operator, Comparison Operator, Range Operator, Logical Operator		
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: Swift Programming Version - 5		

B.Tech (Computer Science & Engineering)

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2[#]	4	-	-	4
6		VAC – 4[**]	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
9		Backend Web Development	3	-	-	3
10		Backend Web Development	-	-	2	1
TOTAL			**21**	**2**	**8**	**27**

<table>
<tr><td colspan="8">Semester - 4</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Backend Web Development</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 5</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this program, the trainer will guide you through the process of Design database required in Web Development and app Development.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To follow the human interface design guidelines laid by iPhone.
2. To understand the concept of Product Visual sensation.
3. To acquire knowledge on Swift Programming.
4. To acquire knowledge on SQL and Node JS.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. Understanding the database Guidelines of Mobile Application and Web App.
2. Gaining knowledge of Swift Programming.
3. Importance of Documentation during development.
4. Database Development.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td>Number of lectures = 5</td><td colspan="5">Introduction To Backend Web Development</td></tr>
<tr><td colspan="8">Installing Node, Installing Code Editor, JS (Java Script) Introduction, JS Elements</td></tr>
<tr><td colspan="2">Unit – 2</td><td>Number of lectures = 7</td><td colspan="5">Node Essentials</td></tr>
</table>

Semester - 4		
What is Node.js, NPM, Modules, and a Node Program, First HTTP Server, HTTP and Web Request, JSON, Nodemon, and More Advanced Functionality.		
Unit – 3	**Number of lectures = 8**	**Node and Express | Fortunes API**
Setting Up The Fortunes API, JSON for Fortunes, First Express Endpoint, Random Fortune or One by ID, Fortunes Post Method, Clean the Fortunes Post Method and Use Postman, Update Fortunes with Put, Delete Fortunes.		
Unit – 4	**Number of lectures = 10**	**SQL, Database, and PostgreSQL**
SQL, the Relational Model, and PostgreSQL, PSQL Installation, Create Tables and Insertion, Creating SQL Scripts, Selecting Table Data, Relational Tables, Joining Tables.		
Unit – 5	**Number of lectures = 10**	**Node and PostgreSQL App | Monsters API**
Setting up the Monsters API, Node SQL Configure Script, Optional: Configure with Password, Configure the Postgres Pool, Monsters GET Request with Express, Error Handling in Express with Middleware, Monsters Get by ID and Express Routes, Monsters Post Method, Monsters Put Method, Monsters Delete Method, The Habitats Route, Relations and more Advanced Queries.		
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: Learning Node.js		

B.Tech (Computer Science & Engineering)

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3#	4	-	-	4
6		AECC – 3*	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Mobile Application Development (iOS Basic)	3	-	-	3
10		Mobile Application Development (iOS Basic) Lab	-	-	2	1
11		Summer Internship-II	-	-	-	1
TOTAL			**21**	**1**	**6**	**26**

<table>
<tr><td colspan="8">Semester - 5</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Mobile Application Development/ iOS Basic</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE ()</td><td>OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td colspan="2">6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 5</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this final program, the trainer will guide how to use design and create an app to impress upon the client with varied design elements. You will also be able to adapt to various tools that the company desires.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To overcome design pitfalls and communicate effectively.
2. To promote skill sets and communication tools during project implementation.
3. To create libraries on design elements</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. The student will get complete all elements with designing an adaptive mobile application.
2. They can make the product usable and intuitive with testing and simulate with ease.
3. Gain complete technical knowledge of User Interface design in App using Xcode IDE.
4. Better understanding of User Experience.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td>Number of lectures = 7</td><td colspan="6">Welcome to iOS App Development Basics</td></tr>
<tr><td colspan="8">RBGImage Class For Moving Forward, Running Code in App, Using Buttons, Using Labels, Using Gestures</td></tr>
</table>

Semester - 5		
Unit – 2	**Number of lectures = 7**	**The Interface Builder**
Creating Interfaces, Intro To Autolayout, Introduction To UI Element, Using Buttons, UI StackView		
Unit – 3	**Number of lectures = 8**	**Storyboards and Table Views**
Starting Point in Storyboard, Introduction To Camera, Introduction To Email, Table Views , Delegates		
Unit – 4	**Number of lectures = 8**	**View Controllers and Navigation View Controllers**
UI View, Tab Bar View Controller, Collection View Controller, Split View Controller, Page View Controller		
Unit – 5	**Number of lectures = 10**	**Machine Learning Using Core ML Framework**
Introduction To Machine Learning, Introduction To Core ML, Vision With Core ML, Healthy image classifier with Core ML.		
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: Swift Programming Version 5.1		

B.Tech (Computer Science & Engineering)

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4[#]	4	-	-	4
5		AECC – 4[*]	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
9		Mobile Application Development (iOS Advance)	3	-	-	3
10		Mobile Application Development (iOS Advance) Lab	-	-	2	1
TOTAL			**18**	**1**	**12**	**26**

<table>
<tr><td colspan="8">Semester - 6</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Mobile Application Development/ iOS Advance</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 5</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this final program, the trainer will guide how to use advance techniques using frameworks and third parties library to design to impress upon the client with varied design elements. You will also be able to adapt to various tools that the company desires.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To overcome design pitfalls and communicate effectively.
2. To promote skill sets and communication tools during project implementation.
3. To create libraries on design elements</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. The student will get complete all elements with designing an adaptive mobile application.
2. They can make the product usable and intuitive with testing and simulate with ease.
3. Gain complete technical knowledge of User Interface design and third parties library.
4. Better understanding of User Experience.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td>Number of lectures = 7</td><td colspan="6">Application Patterns and Architecture</td></tr>
<tr><td colspan="8">Moving Piece Of Architecture, Adding Data Binding With Swift, MVC, Viper For iOS App.</td></tr>
</table>

Semester - 6		
Unit – 2	**Number of lectures = 7**	**UIPickerView and UIDatePicker**
UIPickerView, UIDatePicker View, Scroll View, Text View.		
Unit – 3	**Number of lectures = 10**	**Working with Data**
Sqlite, Core Data, FireBase		
Unit – 4	**Number of lectures = 6**	**Multitouch, Taps, and Gestures**
Tap To Gesture, Pinch Gesture, Rotation Gesture, Swipe Gesture, Core Location Framework and API Integration		
Unit – 5	**Number of lectures = 10**	**Augmented Reality Using ARKit**
Introduction to Augmented Reality, Introduction to ARKit, Positioning Nodes, AR Drawing, Texture and Surfaces, 3D Models and Hit-Testing, AR-Portal.		
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 : Swift Programming Version 5.1 With Xcode		

B.Tech (Computer Science & Engineering)

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		iOS Practical Implementation Techniques	3	-	-	3
7		iOS Practical Implementation Techniques Lab	-	-	2	1
8		Summer Internship-III	-	-	-	2
TOTAL			**9**	**0**	**22**	**22**

<table>
<tr><td colspan="8">Semester - 7</td></tr>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td>iOS Practical Implementation Techniques - Mini Project in an Industry.</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE ()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 0</td><td>Tutorials = 0</td><td colspan="4">Practical = Industry Based</td></tr>
<tr><td colspan="8">8. Course Description</td></tr>
<tr><td colspan="8">In this final program, the trainer will guide how to use IDE for creating an app in an industry.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To overcome design pitfalls and communicate effectively.
2. To promote skill sets and communication tools during project implementation.
3. To create libraries on design elements</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):
1. The student learn how to design, prototype and architect a project of their own design.
2. The student will get complete all elements with designing an adaptive mobile application.
3. They can make the product usable and intuitive with testing and simulate with ease.
4. Gain complete technical knowledge of User Interface design
5. Better understanding of User Experience.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="8">Important points to execute project in an Industry</td></tr>
</table>

Semester - 7
• Designing and building mobile applications for Apple's iOS platform. • Collaborating with the design team to define app features. • Ensuring quality and performance of application to specifications. • Identifying potential problems, technical snags and resolving application bottlenecks. • Fixing application bugs before final release. • Publishing application on App Store. • Maintaining the code and automating the application. • Designing and implementing application updates.

SEMESTER VIII

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

Total Credits: 189

B.Tech.(Computer Science & Engineering) with minors in Blockchains

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Fundamentals of Blockchain	3	-	-	3
11		Summer Internship-I	-	-	-	1
TOTAL			**21**	**-**	**8**	**26**

Semester – III

<table>
<tr><td colspan="8">14. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>15. Course Name</td><td colspan="2">Fundamentals of Blockchain</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>16. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td colspan="2">17. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">18. Pre-requisite (if any)</td><td colspan="2"></td><td>19. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">20. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">21. Course Description: The objective of this course is to teach students the concepts of Blockchain</td></tr>
<tr><td colspan="8">22. Learning objectives:
• The students should be able to understand a broad overview of the essential concepts of blockchain technology.
• To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
• Students should be able to learn about different types of blockchain and consensus algorithms.</td></tr>
<tr><td colspan="8">23. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">e) To explain the basic notion of distributed systems.</td></tr>
<tr><td colspan="8">f) To use the working of an immutable distributed ledger and trust model that defines blockchain.</td></tr>
<tr><td colspan="8">g) To illustrate the essential components of a blockchain platform.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">24. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Basics: The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Technology Stack: Blockchain, Protocol, Currency.

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.</td></tr>
</table>

Unit – 4	**Number of lectures = 10**	Introduction to Data Analytics

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

25. 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:

1. https://www.coursera.org/specializations/blockchain.
2. https://nptel.ac.in/courses/106105184/
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview

26. Books Recommended

Text Books

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
4. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2[#]	4	-	-	4
6		VAC – 4[**]	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
9		Smart Contracts and Solidity	3	-	-	3
10		Smart Contracts and Solidity Lab	-	-	2	1
TOTAL			**21**	**2**	**8**	**27**

Semester – IV

<table>
<tr><td colspan="8">14. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>15. Course Name</td><td colspan="2">Smart Contracts and Solidity</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td>16. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="2">17. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>18. Pre-requisite (if any)</td><td>Fundamentals of Blockchain</td><td colspan="2">19. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">20. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">21. Course Description: The objective of this course is to teach students the about the smart contacts and decentralized applications</td></tr>
<tr><td colspan="8">22. Learning objectives:
1. Students should be able to understand the concept of smart contracts related to blockchain.
2. Students should be able to understand the smart contract higher-level language Solidity and apply it to create smart contracts.
3. Students should be able to learn Truffle IDE for creating and deploying a DApp.</td></tr>
<tr><td colspan="8">23. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">e) To understand the working and importance of smart contracts.</td></tr>
<tr><td colspan="8">f) To learn the solidity language required for coding Ethereum smart contracts.</td></tr>
<tr><td colspan="8">g) To create and deploy a DApp on a Ethereum test network.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">24. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Smart Contracts</td></tr>
<tr><td colspan="8">Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Development Environment:</td></tr>
<tr><td colspan="8">Building A Simple Smart Contract with Solidity, Solc-Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Solidity</td></tr>
<tr><td colspan="8">Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity
Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events</td></tr>
<tr><td>Unit – 4</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Truffle and Dapp</td></tr>
<tr><td colspan="8">Truffle Framework & Ganache: Environment Setup for Truffle & Ganache, Truffle</td></tr>
</table>

Project Creation, Truffle Compile, Migrate and Create Commands.

Decentralized App Creation: Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.

25. 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:

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereum-blockchain/
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview

26. Books Recommended

Text Books

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
4. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher.

27. Laboratory Work

The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3#	4	-	-	4
6		AECC – 3*	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Blockchain Platforms and Use cases	3	-	-	3
10		Blockchain Platforms and Use cases Lab	-	-	2	1
11		Summer Internship-II	-	-	-	1
TOTAL			**21**	**1**	**6**	**26**

Semester – V

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Blockchain Platforms and Use cases</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Smart Contracts and Dapp</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students the concepts about different types of blockchain platforms and decentralized applications</td></tr>
<tr><td colspan="8">9. Learning objectives:
• Students should be able to learn different types of blockchain platforms.
• Students should be able to understand different types of Decentralized applications developed using blockchain technology.
• Students should be able to understand several types of blockchain use cases.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) To distinguish between different types of blockchain platforms.</td></tr>
<tr><td colspan="8">b) To understand different types of uses of blockchain and apply it to some real-life scenarios accordingly.</td></tr>
<tr><td colspan="8">c) To learn about the shortcomings of blockchain technology and their corresponding solutions</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Permissioned Blockchains</td></tr>
<tr><td colspan="8">Hyperledger Fabric Services, Model and Functions, Hyperledger Composer, Microsoft Azure Blockchain Platform and Services, Other Platforms: IOTA, TRON, Ziliqa, Cosmos, Ripple</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Decentralized Application Platforms</td></tr>
<tr><td colspan="8">Augur-Decentralised Prediction Market Platform, Grid+-Energy Ecosystem Platform. Challenges and Solutions Related to Blockchain: Consensus, Scalability, Privacy and Confidentiality, Escrow, and Multi signature.</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Alternative Decentralized Solutions</td></tr>
<tr><td colspan="8">Interplanetary File System (IPFS) Working and Uses, Hash graph- Working, Benefits, And Use-Cases.</td></tr>
</table>

Unit – 4	**Number of lectures = 10**	**Blockchain Use Cases**
Financial Services Related Use Cases, Revolutionization of Global Trade, Digital Identity, Auditing Services, Supply Chain Management, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.		
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: 1. https://nptel.ac.in/courses/106105184/ 2. https://www.coursera.org/learn/blockchain-platforms. 3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview.		
13. Books Recommended		
1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons. 2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House. 3. Building Blockchain Projects, Narayan Prusty, Packt Publishing. 4. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (March 17, 2017). 5. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher publisher/O'Reilly Publisher Media; 1st edition (2015).		
14. Laboratory Work		
The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course		

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4[#]	4	-	-	4
5		AECC – 4[*]	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
9		Blockchain Security and Performance	3	-	-	3
10		Blockchain Security and Performance Lab	-	-	2	1
TOTAL			**18**	**1**	**12**	**26**

Semester – VI

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Blockchain Security and Performance</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Blockchain Platforms</td><td colspan="2">6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="3">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="9">8. Course Description: The objective of this course is to teach students about the security concerns and performance parameters</td></tr>
<tr><td colspan="9">9. Learning objectives:
• Students should be able to understand the security and performance-related issues of blockchain.
• Students should be able to learn techniques and tools to tackle the security related issues of blockchain.
• Students should be able to learn new approaches required for enhancing blockchain performance.</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">a) To understand the security and performance perspective of blockchain technology</td></tr>
<tr><td colspan="9">b) To learn and apply security analysis and performance-enhancing techniques related to blockchain.</td></tr>
<tr><td colspan="9">c) To understand the real-life applications of blockchain technology and apply it to provide solutions to some real-life problems.</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="9">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Security Issues</td></tr>
<tr><td colspan="9">Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Security Tools for Smart Contracts</td></tr>
<tr><td colspan="9">Working, Advantages, And Disadvantages ofTools- Oyente, Securify, Maian, Manticore, Mythril, SmartCheck, Verx. Secure Key Management, Quantum Resilience Keys</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Performance Related Issues</td></tr>
<tr><td colspan="9">Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications.</td></tr>
</table>

Unit – 4	**Number of lectures = 10**	**Performance Improvements**
Off-Chain State Channels, Sidechains, Parallels Chains, Concurrent Smart Contract Transactions, Sharding Technique and Its Benefits, Atomic Swaps Between Smart Contracts.		
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/ **Corresponding Online Resources:** 1. https://www.edx.org/course/blockchain-and-fintech-basics-applications-andlimitations		
13. Books Recommended		
Text Books Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher.		
14. Laboratory Work		
The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course		

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Blockchain in FinTech	3	-	-	3
7		Summer Internship-III	-	-	-	2
TOTAL			**9**	**0**	**20**	**21**

Semester – VII

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Blockchain in FinTech</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td>PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students about practical usage of blockchain in financial sector</td></tr>
<tr><td colspan="8">9. Learning objectives:
• Students should be able to understand the benefits of using blockchain in financial sector.
• Students should understand how decentralized nature of blockchain is impacting banking and financial sector.
• Students should learn blockchain regulations and future trends related to blockchain to be used in financial sector.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) To understand difference between different types of coins and tokens related to blockchain technology.</td></tr>
<tr><td colspan="8">b) To understand the benefits of blockchain in banking sector.</td></tr>
<tr><td colspan="8">c) To understand the concept of decentralized markets.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Cryptocurrencies</td></tr>
<tr><td colspan="8">Concept, Cryptocurrency Mining, Uses of Cryptocurrencies, Tokens, Token vs Crypto Coin, Concept of ICOs (Initial Coin Offerings), Benefits of Using ICOs, STOs (Security token offerings), ICO vs STO, Cryptocurrency wallets.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Decentralized Finance (DeFi)</td></tr>
<tr><td colspan="8">Concept, Benefits and Risks Associated with DeFi, Centralized vs Decentralized finance, DeFi Projects, DeFi future trends.</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4">Decentralized Markets</td></tr>
<tr><td colspan="8">Concept of Decentralized markets, impact of decentralization on financial market, Decentralized Exchanges (DEX), Security, control and privacy concerns related to DEX, Liquidity and Usability of DEX, best DEXs for trading, Fund Management and Trading logic of DEX, Concept of Decentralized Web.</td></tr>
</table>

Unit – 4	Number of lectures = 10	Blockchain in Banking Sector

Cross-Border Payments Using Blockchain and Its Benefits, Study of blockchain platforms used for cross-border payments, Impact of Blockchain on Banking Services.
Stable Coin: Concept, Uses and Types of Stable Coins
Case-Study: Tether and Libra Coins

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/

Corresponding Online Resources:
1. https://www.accenture.com/in-en/insight-blockchain-technology-how-banksbuilding-real-time
2. https://medium.com/search?q=decentralized%20exchange
3. Emerging Technology Projection: The Total Economic Impact™ Of IBM Blockchain https://www.ibm.com/downloads/cas/QJ4XA0MD
4. https://www.globallegalinsights.com/practice-areas/blockchain-laws-andregulations/india#chaptercontent1
5. https://www.eduonix.com/blockchain-and-cryptocurrencies-for-beginners
6. https://www.coursera.org/learn/cryptocurrency

13. Books Recommended

Text Books

1. Melanie Swan, Blockchain: Blueprint for a new economy, Shroff Publisher/O'Reilly Publisher.
2. Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.
3. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.

SEMESTER VIII

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

Total Credits: 179

B.Tech. (Computer Science & Engineering) with minors in Data Science

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Introduction to Data Science	3	-	-	3
11		Introduction to Data Science Lab	-	-	2	1
12		Summer Internship-I	-	-	-	1
TOTAL			**21**	**-**	**10**	**27**

Semester – III

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>2. Course Name</td><td colspan="2">Introduction to Data Science</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="2">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td>Statistics</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description:
This course is to teach students the concepts concerning basics of data science</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To Provide the knowledge and expertise to become a proficient data scientist;
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
3. Produce Python code to statistically analyse a dataset;
4. Critically evaluate data visualisations based on their design and use for communicating stories from data;</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">h) To explain how data is collected, managed and stored for data science.</td></tr>
<tr><td colspan="8">i) To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.</td></tr>
<tr><td colspan="8">j) To implement data collection and management scripts using MongoDB.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 14</td><td colspan="5"></td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 8</td><td colspan="5"></td></tr>
<tr><td colspan="8">Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.</td></tr>
</table>

Unit – 4	**Number of lectures = 8**	
Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.		

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/106106212

13. Books Recommended

Text Books

1. Data Sciences & Analytics, V.K. Jain, Khanna Publishing House.
2. Business Analytics: The Science of Data - Driven Decision Making, U Dinesh Kumar, John Wiley & Sons.
3. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, John Wiley & Sons.
4. Joel Grus, Data Science from Scratch, Shroff Publisher/O'Reilly Publisher Media
5. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
6. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.
7. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
8. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher/O'Reilly Publisher Media.

14. Laboratory Work

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

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2[#]	4	-	-	4
6		VAC – 4[**]	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
9		Introduction to AI and ML	3	-	-	3
10		Introduction to AI and ML Lab	-	-	2	1
TOTAL			**21**	**2**	**8**	**27**

Semester – IV

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Introduction to AI and ML</td><td colspan="2">L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2">3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Statistics</td><td>6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="3">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description:
This course is to teach students the concepts concerning Artificial Intelligence and Machine Learning</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To understand basics of machine learning in data science.
2. To understand various basic machine learning algorithm that can be used with various type of data.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) To explain how data is collected, managed and stored for data science.</td></tr>
<tr><td colspan="8">b) To use various type of Machine learning model.</td></tr>
<tr><td colspan="8">c) To implement various ML algorithms on data models.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 14</td><td colspan="4"></td></tr>
<tr><td colspan="8">Linear Regression: Basic facts of linear regression, implementation of linear regression, case studies of linear regression using data set
Logistic Regression: Basic facts and implementation of logistic regression, solve a case study to predict output using existing data set</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Clustering and Principal Component Analysis: K means and hierarchical clustering, how to make market strategies using clustering, recommendation and PCA</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Support Vector Machine: basics of SVM and use it to detect the spam emails and recognize alphabets</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Model Selection and advanced regression: use of Lasso and Ridge</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

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

Online Resources:

https://nptel.ac.in/courses/106105152

13. Books Recommended

Text Books

1. Machine Learning using Python , U Dinesh Kumar and Manaranjan Pradhan, John Wiley & Sons.
2. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Publishing House.
3. Machine Learning, V.K. Jain, Khanna Publishing House.
4. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning by By Sayan Mukhopadhyay, Apress.
5. Practical Data Mining" by Monte F. Hancock, Auerbach Publication.
6. "Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald.
7. Practical Data Science with R, Nina Zumel, John Wiley & Sons.
8. Python for Data Science for Dummies, John Paul Mueller, Luca Massaron, John Wiley & Sons.
9. Big Data and Analytics, Seema Acharya and Subhashini Chellappan, Wiley Publication.
10. Introduction to Machine Learning, Jeeva Jose, Khanna Publishing House.

14. Laboratory Work

1. Use python to predict employee attrition in a firm and help them plan their manpower. (take data set from kaggle).
2. Create customer clusters using different market strategies on a data set.
3. Make a movie recommendation system.
4. Develop a prediction mechanism to predict which employee can go on leave in a company in near future.
5. Recognizing alphabets using SVM.

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3#	4	-	-	4
6		AECC – 3*	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Computational Data Analytics	3	-	-	3
10		Computational Data Analytics Lab	-	-	2	1
11		Summer Internship-II	-	-	-	1
TOTAL			**21**	**1**	**6**	**26**

Semester – V

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Computational Data Analytics</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Probability Theory</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description:
This course is to teach students about the R Programming. This course enables the student to deal with real-time problem using mathematical modelling.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To learn how to think about your study system and research question of interest in a systematic way in order to design an efficient sampling and experimental research program.
2. To understand how to analyze collected data to derive the most information possible about your research questions.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After completion of course, students would be able to</td></tr>
<tr><td colspan="8">a) To explain how data is collected, managed and stored for data science.</td></tr>
<tr><td colspan="8">b) When to use which type of Machine learning model.</td></tr>
<tr><td colspan="8">c) Implement various ML algorithms on data models.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 12</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction to R Computing language. Best practices in executing Reproducible Research in data science, Sampling and Simulation. Descriptive statistics, and the creation of good observational sampling designs.
Data visualization, Data import and visualization, Introduction to various plots</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Frequentist Hypothesis Testing, Z-Tests, Power Analysis</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Linear regression, diagnostics, visualization, Likelihoodist Inference, Fitting a line with Likelihood, Model Selection with one predictor</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Bayesian Inference, Fitting a line with Bayesian techniques, Multiple Regression and Interaction Effects, Information Theoretic Approaches</td></tr>
<tr><td colspan="8">12. Brief Description of self-learning / E-learning component</td></tr>
</table>

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/111104146

https://www.coursera.org/specializations/data-science-foundations-r

https://www.coursera.org/specializations/jhu-data-visualization-dashboarding-with-r

13. Books Recommended

Text Books

1. Beginner's Guide for Data Analysis using R Programming, Khanna Publishing House
2. Practical Data Science with R, Nina Zumel, John Wiley & Sons.
3. Big Data & Hadoop, V.K. Jain, Khanna Publishing House.
4. N. C. Das, Experimental Designs in Data Science with Least Resources, Shroff Publisher Publisher.
5. Hadley Wickham, Garret Grolemund, *R for Data Science*, Shroff Publisher/O'Reilly Publisher Publisher
6. Benjamin M. Bolker. *Ecological Models and Data in R*. Princeton University Press, 2008. ISBN 978-0-691-12522-0.
7. John Fox and Sanford Weisberg. *An R Companion to Applied Regression*. Sage Publications, Thousand Oaks, CA, USA, second edition, 2011. ISBN 978-1-4129-7514-8.

14. Laboratory Work

1. To give a basic insight of R and its various libraries.
2. Libraries in R. R as a Data Importing Tool, Dplyr. Forcats.
3. Simulation and Frequentist Hypothesis testing, Simulation and Power.
4. Bayesian computation in R, Fitting a line with Bayesian techniques.

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
9		Web Data Mining	3	-	-	3
TOTAL			**18**	**1**	**10**	**25**

Semester – VI

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Web Data Mining</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">0</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2"></td><td>6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 0</td></tr>
<tr><td colspan="8">8. Course Description:
This course is to concern the applications of data science for collecting and processing information from web..</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To learn how to extract data from the Web.
2. To understand how to analyze collected data to derive the most information</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After completion of course, students would be able to</td></tr>
<tr><td colspan="8">a) To explain how data is can be collected from the Web.</td></tr>
<tr><td colspan="8">b) To extract data and information from the webpages.</td></tr>
<tr><td colspan="8">c) To make decision based on the data collected.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction to internet and WWW, Data Mining Foundations, Association Rules and Sequential Patterns, Basic Concepts of Association Rules, Apriori Algorithm, Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports, Extended Model, Mining Algorithm, Rule Generation</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on Prefix Span, Generating Rules from Sequential Patterns</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Concepts of Information Retrieval, IR Methods, Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-processing, Stopword Removal, Stemming, Web Page Pre-processing, Duplicate Detection, Inverted Index and Its Compression, Inverted Index, Search using Inverted Index, Index Construction, Index Compression, Latent Semantic Indexing, Singular Value Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 8</td><td colspan="4"></td></tr>
<tr><td colspan="8">Opinion Mining, Sentiment Classification, Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization, Problem Definition, Object feature extraction, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam.</td></tr>
</table>

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. Mining the Web: Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan Kaufmann Publishers.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer Publications, 2011.
3. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Second Edition, Elsevier Publications 2010.
4. Anthony Scime, Web Mining: Applications and Techniques, 2005.
5. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
6. Mathew Russell, Mining the Social Web 2nd Edition, Shroff Publisher/O'Reilly Publisher Publication.
7. Data Mining and Data Warehousing Principles and Practical Techniques, Parteek Bhatia, Cambridge University Press.
8. Data Mining & Business Intelligence, Balram Krishan, Khanna Publishing House

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Analysing, Visualizing and Applying data science with Python	3	-	-	3
7		Analysing, Visualizing and Applying data science with Python Lab	-	-	2	1
8		Summer Internship-III	-	-	-	2
TOTAL			**9**	**0**	**22**	**22**

Semester – VII

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>2. Course Name</td><td colspan="2">Analysing, Visualizing and Applying data science with Python</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="2">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td>Statistics and Python Programming</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description:
This course is to teach students presenting the analyzed data that is visually understandable</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To learn how to use python for data science.
2. To understand and use all the tools and libraries of python for data science..</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">After completion of course, students would be able to</td></tr>
<tr><td colspan="8">a) To apply Pandas for data preparation.</td></tr>
<tr><td colspan="8">b) To apply Numpy for data nalysis</td></tr>
<tr><td colspan="8">c) Implement various ML algorithms using Scikit-Learn Library.</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Data Analysis libraries: will learn to use Pandas Data Frames, Numpy multi-dimentional arrays, and SciPy libraries to work with a various dataset.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Pandas, an open-source library, and we will use it to load, manipulate, analyze, and visualize various datasets.</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Scikit-learn, and we will use some of its machine learning algorithms to build smart models and make predictions, various parameters that can be used to compare various parameters.</td></tr>
<tr><td>Unit – 4</td><td colspan="2">Number of lectures = 8</td><td colspan="5"></td></tr>
<tr><td colspan="8">Descriptive Statistics, Basic of Grouping, ANOVA, Correlation, Polynomial Regression and Pipelines, R-squared and MSE for In-Sample Evaluation, Prediction and Decision Making</td></tr>
<tr><td colspan="8">12. Brief Description of self-learning / E-learning component</td></tr>
</table>

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/106106212

13. Books Recommended

Text Books

1. Taming Python by Programming, Jeeva Jose, Khanna Publishing House.
2. Data Visualization with Python and JavaScript, Kyran Dale, Shroff Publisher/O'Reilly Publisher Publication.
3. Data Science Using Python and R by Chantal D. Larose and Daniel T. Larose, Wiley Publication.
4. Data Science & Analytics (with Python, R, SPSS Programming), V.K. Jain, Khanna Publishing House.
5. Python for Data Science and Visualization -Beginners to Pro, Udemy.

14. Laboratory Work

1. Demonstrate knowledge of Data Science and Machine Learning.
2. Apply Data Science process to a real-life scenario.
3. Explore New York City - 311 Complaints and Housing datasets.
4. Analyze and Visualize data using Python.
5. Perform feature engineering exercise using Python.
6. Build and validate predictive machine learning model using Python.
7. Create and share Actionable Insights to real life data problems.

SEMESTER VIII

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

Total Credits: 180

B.Tech. (Computer Science & Engineering) with minors in Cyber Security

SEMESTER III

S.No	Course Code	Course Title	L	T	P	C
1		Introduction to MATLAB	3	-	-	3
2		Data Structure and Algorithms	3	-	-	3
3		Operating Systems	3	-	-	3
4		Digital Electronics	3	-	-	3
5		MGE-1[#]	4	-	-	4
6		VAC – 3[**]	2	-	-	2
7		Introduction to MATLAB Lab	-	-	2	1
8		Data Structure and Algorithms Lab	-	-	4	2
9		Operating Systems Lab	-	-	2	1
10		Information Theory for Cyber Security	3	-	-	3
11		Information Theory for Cyber Security Lab	-	-	2	1
12		Summer Internship-I	-	-	-	1
TOTAL			**21**	**-**	**10**	**27**

Semester – III

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Information Theory for Cyber Security</td><td>L</td><td colspan="2">T</td><td>P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td>2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Probability Theory</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students the concepts concerning coding techniques and error correction mechanism</td></tr>
<tr><td colspan="8">9. Learning objectives:
The objective of this course is to provide an insight to information coding techniques, error correction mechanism for cyber security.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">k) To introduce the principles and applications of information theory.</td></tr>
<tr><td colspan="8">l) To justify how information is measured in terms of probability and entropy.</td></tr>
<tr><td colspan="8">m) To learn coding schemes, including error correcting codes.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Shannon’s foundation of Information theory, Random variables, Probability distribution factors, Uncertainty/entropy information measures, Leakage, Quantifying Leakage and Partitions, Lower bounds on key size: secrecy, authentication and secret sharing. provable security, computationally-secure, symmetric cipher.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Secrecy, Authentication, Secret sharing, Optimistic results on perfect secrecy, Secret key agreement, Unconditional Security, Quantum Cryptography, Randomized Ciphers, Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Information-theoretic security and cryptograph, basic introduction to Diffie-Hellman, AES, and side-channel attacks.</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Secrecy metrics: strong, weak, semantic security, partial secrecy, Secure source coding: rate-distortion theory for secrecy systems, side information at receivers, Differential privacy, Distributed channel synthesis, Light weight cryptography, Elliptic Curve Cryptography and applications.</td></tr>
</table>

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. Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley & Sons.
2. Communication Systems: Analog and digital, Singh and Sapre, Tata McGraw Hill.
3. Fundamentals in information theory and coding, Monica Borda, Springer.
4. Information Theory, Coding and Cryptography R Bose.
5. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House.
6. Multi-media System Design, Prabhat K Andleigh and Kiran Thakrar.

14. Laboratory Work

The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C
1		Discrete Mathematics	3	1	-	4
2		Design and Analysis of Algorithms	3	-	-	3
3		Database Management Systems	3	1	-	4
4		Computer Organization and Architecture	3	-	-	3
5		MGE – 2[#]	4	-	-	4
6		VAC – 4[**]	2	-	-	2
7		Design and Analysis of Algorithms Lab	-	-	2	1
8		Database Management Systems Lab	-	-	4	2
9		Data Encryption	3	-	-	3
10		Data Encryption Lab	-	-	2	1
TOTAL			**21**	**2**	**8**	**27**

Semester – IV

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Data Encryption</td><td>L</td><td>T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td>3</td><td>0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core (✓)</td><td>PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Linear Algebra, Cryptography</td><td>6. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">8. Course Description: The objective of this course is to teach students the concepts of encryption and compression.</td></tr>
<tr><td colspan="8">9. Learning objectives:
This course will cover the concept of security, types of attack experienced, encryption and authentication for deal with attacks, what is data compression, need and techniques of data compression.</td></tr>
<tr><td colspan="8">10. Course Outcomes (COs): Students will have the knowledge</td></tr>
<tr><td colspan="8">h) of plain text and cipher text</td></tr>
<tr><td colspan="8">i) of RSA and other cryptographic algorithm</td></tr>
<tr><td colspan="8">j) of Key Distribution, communication model</td></tr>
<tr><td colspan="8">k) Various models for data compression</td></tr>
<tr><td colspan="8">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.
Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm.</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Case Studies of Cryptography: Denial of service attacks, IP spoofing attacks, Conventional Encryption and Message Confidentiality, Conventional Encryption Algorithms, Key Distribution.
Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital Signatures, Key Management, Firewall.</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 10</td><td colspan="4"></td></tr>
<tr><td colspan="8">Need for data compression, Fundamental concept of data compression & coding, Data compression-- Loss less & Lossy, Statistical encoding-- Huffman, Arithmetic & Lempel-Ziv coding</td></tr>
</table>

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/106105162

13. Books Recommended

Text Books

1. Cryptography and Network Security, Mohammad Amjad, John Wiley & Sons.
2. Cryptography & Network Security by Atul Kahate, TMH.
3. Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley & Sons.
4. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
5. The Data Compression Book by Nelson, BPB.
6. Cryptography & Network Security, V.K. Jain, Khanna Publishing House.

14. Laboratory Work

The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course

SEMESTER V

S.No	Course Code	Course Title	L	T	P	C
1		Formal Language and Automata Theory	3	1	-	4
2		Object Oriented Programming	3	-	-	3
3		Computer Networks	3	-	-	3
4		Software Engineering	3	-	-	3
5		MGE - 3[#]	4	-	-	4
6		AECC – 3[*]	2	-	-	2
7		Object Oriented Programming Lab	-	-	2	1
8		Computer Networks Lab	-	-	2	1
9		Steganography and Digital Watermarking	3	-	-	3
11		Summer Internship-II	-	-	-	1
TOTAL			**21**	**1**	**4**	**25**

Semester – V

<table>
<tr><td colspan="8">1. Name of the Department- Computer Science Engineering</td></tr>
<tr><td colspan="2">2. Course Name</td><td colspan="2">Steganography and Digital Watermarking</td><td colspan="2">L – 3</td><td colspan="2">T – 0</td><td>P – 0</td></tr>
<tr><td colspan="2">3. Course Code</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td colspan="2">Core (✓))</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td colspan="2">Linear Algebra</td><td>6. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="9">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td colspan="2">Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="9">8. Course Description: The objective of this course is to teach students the concepts of data hiding and data integrity</td></tr>
<tr><td colspan="9">9. Learning objectives:
The objective of course is to provide an insight to steganography techniques. Watermarking techniques along with attacks on data hiding and integrity of data is included in this course.</td></tr>
<tr><td colspan="9">10. Course Outcomes (COs):</td></tr>
<tr><td colspan="9">a) Learn the concept of information hiding</td></tr>
<tr><td colspan="9">b) Survey of current techniques of steganography and learn how to detect and extract hidden information.</td></tr>
<tr><td colspan="9">c) Learn watermarking techniques and through examples understand the concept.</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td colspan="9">11. Unit wise detailed content</td></tr>
<tr><td colspan="2">Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Steganography Overview, History, Methods for hiding (text, images, audio, video, speech etc.). Steganalysis: Active and Malicious Attackers, Active and passive Steganalysis</td></tr>
<tr><td colspan="2">Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Frameworks for secret communication (pure steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive).</td></tr>
<tr><td colspan="2">Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Steganography techniques: Substitution systems, Spatial Domain, transform domain techniques, Spread spectrum, Statistical steganography</td></tr>
<tr><td colspan="2">Unit – 4</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="9">Digital Watermarking: Introduction, Difference between Watermarking and Steganography, Classification (Characteristics and Applications), types and techniques (Spatial-domain, Frequency-domain, and Vector quantization-based watermarking), Watermark security & authentication.</td></tr>
<tr><td colspan="9">12. Brief Description of self-learning / E-learning component</td></tr>
</table>

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/

Corresponding Online Resources:
1. Cyber Security, https://swayam.gov.in/nd2_cec20_cs09/preview.
2. Introduction to Cyber Security, https://swayam.gov.in/nd2_nou20_cs01/preview

13. Books Recommended

Text Books

1. Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, New York, 2008.
3. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.
4. Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas.

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C
1		Compiler Design	3	1	-	4
2		Program Elective - I	3	-	-	3
3		Program Elective - II	3	-	-	3
4		MGE – 4#	4	-	-	4
5		AECC – 4*	2	-	-	2
6		Design Thinking	-	-	2	2
7		Program Elective - I Lab	-	-	4	2
8		Program Elective - II Lab	-	-	4	2
9		Security Assessment and Risk Analysis	3	-	-	3
TOTAL			**18**	**1**	**10**	**25**

Semester – VI

<table>
<tr><td colspan="8">15. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>16. Course Name</td><td colspan="2">Security Assessment and Risk Analysis</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>17. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td colspan="2">18. Type of Course (use tick mark)</td><td>Core (✓))</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>19. Pre-requisite (if any)</td><td>Network Security</td><td>20. Frequency (use tick marks)</td><td>Even (✓)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">21. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">22. Course Description: The objective of this course is to teach students about the best practices in implementing security.</td></tr>
<tr><td colspan="8">23. Learning objectives:
Describe the concepts of risk management in information security. Define and differentiate various Contingency Planning components. Define and be able to discuss incident response options, and design an Incident Response Plan for sustained organizational operations.</td></tr>
<tr><td colspan="8">24. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">d) To apply contingency strategies including data backup and recovery and alternate site selection for business resumption planning</td></tr>
<tr><td colspan="8">e) To Skilled to be able to describe the escalation process from incident to disaster in case of security disaster.</td></tr>
<tr><td colspan="8">f) To Design a Disaster Recovery Plan for sustained organizational operations.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">25. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security countermeasures-education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security countermeasures-policy, procedures and practices, threats, vulnerabilities.</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Threats to and Vulnerabilities of Systems: Threats, major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS). Countermeasures: assessments (e.g., surveys, inspections). Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis and implementation of controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information).</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5">Symmetric Encryption</td></tr>
<tr><td colspan="8">Security Planning: directives and procedures for policy mechanism. Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations,</td></tr>
</table>

contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event.		
Unit – 4	**Number of lectures = 10**	**Asymmetric Encryption**
Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography-encryption (e.g., point-to-point, network, link).		
26. 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/ **Corresponding Online Resources:** 1. Introduction to Cyber Security, https://swayam.gov.in/nd2_nou20_cs01/preview 2. (Web Link) http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf		
27. Books Recommended		
Text Books **Text Books/References:** 1. Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, John Wiley & Sons. 2. Principles of Incident Response and Disaster Recovery, Whitman & Mattord, Course Technology ISBN: 141883663X.		

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
1		Program Elective - III	3	-	-	3
2		Program Elective - IV	3	-	-	3
3		Program Elective - III Lab	-	-	4	2
4		Program Elective - IV Lab	-	-	4	2
5		Project	-	-	12	6
6		Database Security and Access Control	3	-	-	3
7		Database Security and Access Control Lab	-	-	2	1
8		Summer Internship-III	-	-	-	2
TOTAL			**9**	**0**	**22**	**22**

Semester – VII

<table>
<tr><td colspan="8">14. Name of the Department- Computer Science Engineering</td></tr>
<tr><td>15. Course Name</td><td colspan="2">Database Security and Access Control</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>16. Course Code</td><td colspan="2"></td><td>3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="2">17. Type of Course (use tick mark)</td><td>Core (✓)</td><td colspan="2">PE()</td><td colspan="2">OE ()</td></tr>
<tr><td>18. Pre-requisite (if any)</td><td colspan="2"></td><td>19. Frequency (use tick marks)</td><td>Even ()</td><td>Odd (✓)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">20. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 40</td><td>Tutorials = 0</td><td colspan="4">Practical = 28</td></tr>
<tr><td colspan="8">21. Course Description: The objective of this course is to teach students about securing database servers.</td></tr>
<tr><td colspan="8">22. Learning objectives:
The objective of the course is to provide fundamentals of database security. Various access control techniques mechanisms were introduced along with application areas of access control techniques.</td></tr>
<tr><td colspan="8">23. Course Outcomes (COs):</td></tr>
<tr><td colspan="8">a) To understand and implement classical models and algorithms.</td></tr>
<tr><td colspan="8">b) To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.</td></tr>
<tr><td colspan="8">c) To assess the strengths and weaknesses of various access control models and to analyze their behaviour.</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">24. Unit wise detailed content</td></tr>
<tr><td>Unit-1</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Introduction to Access Control, Purpose and fundamentals of access control</td></tr>
<tr><td>Unit – 2</td><td colspan="2">Number of lectures = 10</td><td colspan="5"></td></tr>
<tr><td colspan="8">Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.</td></tr>
<tr><td>Unit – 3</td><td colspan="2">Number of lectures = 10</td><td colspan="5">SQL Injection and Web Application Exploits</td></tr>
<tr><td colspan="8">Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments</td></tr>
<tr><td>Unit – 4</td><td colspan="2">Number of lectures = 10</td><td colspan="5">MITM Attack and Social Engineering</td></tr>
<tr><td colspan="8">Smart Card based Information Security, Smart card operating system-fundamentals, design and implantation principles, memory organization, smart card files, file</td></tr>
</table>

management.

Cloud Data Security: Recent trends in Database security and access control mechanisms. Cloud Data Audit: Intro, Audit, Best Practice, Key management, Cloud Key Management Audit.

25. 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/

Corresponding Online Resources:

1. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.
2. Advanced System Security Topics, https://www.coursera.org/lecture/advancedsystem-security-topics/role-based-access-control-rbac-bYvzS.

26. Books Recommended

Text Books

1. Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.

27. Laboratory Work

The lab exercise will be given by instructor based on theory. At least 10 experiments to be performed from the course

SEMESTER VIII

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

Total Credits: 179