Scheme of Teaching, Examination and Syllabus

B.E. COMPUTER SCIENCE AND ENGINEERING

Batch: 2021-22

Fourth Year

(VII and VIII SEMESTER)

(Effective from the academic year 2025-2026)

Sree Siddaganga Education Society®

Siddaganga Institute of Technology

(An Autonomous institute affiliated to Visvesvaraya Technological University, Belagavi)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A++' and ISO 9001-2015 certified)

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VISION:

To work towards the vision of the institution by building a strong teaching and research environment that is capable of responding to the challenges of the 21st century.

MISSION:

To prepare under graduate, graduate and research students for productive careers in industry and academia, through comprehensive educational programs, entrepreneurship skills, research in collaboration with industry & government, dissemination by scholarly publications, co-curricular activities and professional society associations.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs):

- Pursue successful careers in State/National/Multi-National companies as software developers by following sound professional and ethical practices in various cadres in key areas like networking, web design, cloud computing, big data processing, IoT, e-commerce, information security and so on.
- Work effectively in multi-disciplinary and multi-cultural teams and demonstrate good soft skills.
- Pursue higher education for a successful career in industry/academics/ research.
- Pursue life-long learning, by anticipating trends in computer science and engineering, to excel in industry/academia or own a startup for a successful career as entrepreneur.

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **PSO1: Computer based systems development:** Ability to apply the basic knowledge of database systems, computing, operating system, digital circuits, microcontroller, computer organization and architecture in the design of computer based systems.
2. **PSO2: Software development:** Ability to specify, design and develop projects, application softwares and system softwares by using the knowledge of data structures, analysis and design of algorithm, programming languages, software engineering practices and open source tools.
3. **PSO3: Computer communications and Internet applications:** Ability to design and develop network protocols and internet applications by incorporating the knowledge of computer networks, communication protocol engineering, cryptography and network security, distributed and cloud computing, data mining, big data analytics, ad hoc networks, storage area networks and wireless sensor networks.

SCHEME OF TEACHING AND EXAMINATION (2022 Scheme) (w.e.f. 2025-26)

VII Semester (Swappable VII and VIII Semester)

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	IPCC	S7CSI01	Cyber Security(I)		3	0	2		3	50	50	100	4
2.	IPCC	S7CSI02	Full Stack Development(I)		3	0	2		3	50	50	100	4
3.	PCC	S7CS01	Real Time Big Data Analytics		3	2	0		3	50	50	100	4
4.	PEC		Professional Elective Course-III		3	0	0		3	50	50	100	3
5.	OEC		Open Elective Course-II		3	0	0		3	50	50	100	3
6.	PROJ	S7CSMP	Major Project Phase II		0	0	12		3	100	100	200	6
			Total							**350**	**350**	**700**	**24**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: IPCC: Integrated Professional Core Course, **PCC**: Professional Core Course; **PEC**: Professional Elective Course**;**
OEC: Open Elective Course; **PROJ:** Project Phase –II;
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course (PEC) (Offered by the Department)

S7CSPE01	Deep Learning	**S7CSPE03**	Natural Language Processing
S7CSPE02	Generative AI and Prompt Engineering	**S7CSPE04**	Quantum Computing
S7CCSPE03	Agentic AI – Foundations And Applications		

Note: VII and VIII semesters of IV years of the program

1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.
2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2022-23 may please be referred.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Work: The objective of the Project work is

i) To encourage independent learning and the innovative attitude of the students.

ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

iii) To impart flexibility and adaptability.

iv) To inspire team working.

v) To expand intellectual capacity, credibility, judgment and intuition.

vi) To adhere to punctuality, setting and meeting deadlines.

vii) To install responsibilities to oneself and others.

viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

   The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

SCHEME OF TEACHING AND EXAMINATION (2022 Scheme) (w.e.f. 2025-26)

VIII Semester (Swappable VII and VIII Semester)

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PEC		Professional Elective (Online Courses) *[Details of the scheme will be intimated soon]*		3	0	0		3	50	50	100	3
2.	OEC		Open Elective (Online Courses) *[Details of the scheme will be intimated soon]*		0	2	0		3	50	50	100	3
3.	INT		Internship (Industry/Research) (14-20 weeks)		0	0	12		3	100	100	200	10
			Total							**200**	**200**	**400**	**16**
		AAP	AICTE Activity Points (Applicable for both Regular and Lateral Entry students)	40 hours community service to be documented and produced for the examination									

Note: **PEC**: Professional Elective Course**; OEC:** Open Elective Course (Online); **INT:** Industry Internship / Research Internship / Rural Internship
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective (Online Courses – suggested by BoS, NPTEL)			
Open Elective (Online Courses – suggested by BoS, NPTEL)			

Note: VII and VIII semesters of IV years of the program

1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.
2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for

the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. University shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

Scheme of Teaching, Examination and Syllabus

B.E. COMPUTER SCIENCE & ENGINEERING

Batch: 2021-22

VII SEMESTER

(Effective from the academic year 2025-2026)

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

CYBER SECURITY(I)

Course Code	**S7CSI01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	42 Hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Illustrate the understanding of Cyber Security Fundamentals (Comprehension).
2. Analyses the attacker motivation and the techniques used by them to break the security of the application (Analyses and Application).
3. Study the vulnerabilities in applications and networks. Analyses the possible attacks that can be built by the hackers (Analyses and Application).
4. Evaluation of Malicious code and analysis of attacks against Privileged User Accounts (Analysis and Evaluation)
5. Analysis of Defence Techniques for Cyber Security. (Analysis)

UNIT-1 **(09hrs)**

Cyber Security Fundamentals: Network and Security Concepts, Information Assurance Fundamentals, Basic Cryptography, Symmetric Encryption, Public Key Encryption. The Domain Name System (DNS), Firewalls.

Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control,, Example: UNIX File Access Control , Role-Based Access Control.

UNIT-2 **(09hrs)**

Attacker Techniques and Motivations: How Hackers Cover Their Tracks (Anti-forensics), How and Why Attackers Use Proxies, Tunneling Techniques, Fraud Techniques, Phishing, Smishing, Vishing and Mobile Malicious Code, Rogue Anti-Virus, Click Fraud, Threat Infrastructure, Botnets, Fast-Flux, Advanced Fast-Flux

UNIT-3 **(08 hrs)**

Exploitation: Techniques to Gain a Foothold, Shellcode, Integer Overflow, Vulnerabilities, StackBased Buffer Overflows, Format-String Vulnerabilities, SQL Injection, Malicious PDF Files, Race Conditions, Web Exploit Tools, DoS Conditions, Brute-Force and Dictionary Attacks, Misdirection, Reconnaissance and Disruption Methods, Cross-Site Scripting (XSS), Social Engineering, WarXing, DNS Amplification Attacks.

UNIT-4 **(08 hrs)**

Malicious Code: Self-Replicating Malicious Code, Worms, Viruses, Evading Detection and Elevating Privileges, Obfuscation, Virtual Machine Obfuscation, Persistent Software Techniques, Rootkits, Spyware, Attacks against Privileged User Accounts and Escalation of Privileges, Token Kidnapping, Virtual Machine Detection, Stealing Information and Exploitation, Form Grabbing, Man-in-the-Middle Attacks, DLL Injection, Browser Helper Object

UNIT-5 **(08 hrs)**

Defense and Analysis Techniques: Memory Forensics, Why Memory Forensics Is Important, Capabilities of Memory Forensics, Memory Analysis Frameworks, Dumping Physical Memory, Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems, Passive Analysis, Active Analysis, Physical or Virtual Machines, Intrusion Detection Systems, Cyber Security Essentials.

Open Source Security Tools:

Port Scanners: Installing Nmap on Linux and windows.

Intrusion Detection Systems: Unique Features of Snort, Configuring Snort for Maximum performance.
Analysis and Management Tools: Using Databases and Web Servers to Manage Your Security Data.
Forensic Tools: Preparing for Good Forensic, Forensic Analysis Tools, Making Copies of Forensic and Creating and Logging into a Case.

LAB COMPONENT:
Lab 1: Introduction to necessary tools and open-source software tools ZAP proxy and Burp suite.
Lab 2: Certificates and MITM attack.
Lab 3: DOS, DDOS, and Open SSL certification
Lab 4: Memory corruption exploits.
Lab 5: XSS and SQL injection attacks.
Lab 6: Hashing, password cracking, and biometrics.
Lab 7: Malware evasion strategies
Lab 8: Penetration testing, IDSs
Lab 9: OS security, system call filters.
Lab 10: Simple penetration testing tasks using Python (Eg: port scanning, vulnerability scanning with tools like Nmap in Python.
Lab 11: Using python to interact with security-related APIs (eg. VirusTotal, Shodan)
Lab 12: Using Python scripts for basic static malware analysis (file signature analysis, string extraction).

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

1. Apply the cryptographic concepts underlying Cyber Security.
2. Analyze the techniques used by hackers to create frauds
3. Analyze the vulnerabilities in a network or in an application that will help hackers to build the attack.
4. Analyze various types of malicious codes and security tools
5. Demonstrate Memory Forensics as a defense technique for Cyber Security.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	**Cyber Security Essentials**	James Graham, Richard Howard, Ryan Olson	CRC Press	**2011**
Reference Books				
1	**Computer Security _ Principles**	William Stallings, Lawrie Brown, Mick Bauer	Pearson publications	2nd editions and 2012

Course Articulation Matrix (CO-PO and CO_PSO MAPPING)

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2		2											2
CO2		2			2									2
CO3		2												2
CO4		2												2
CO5		2												2
Overall CO	2	2	2		2									2

Program Articulation Matrix:

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	2	2	2		2									2

B.E. COMPUTER SCIENCE & ENGINEERING Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER - VII			
Full Stack Development with Django			
Course Code	S7CSI02	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:1)	SEE Marks	50
Credits	3	Exam Hours	3
Lecture Hours	39Hrs	Practical Hours	-

Course objectives: This course will enable students to:	
1.	Analyze the evolution of web technologies and compare modern technology stacks and methodologies for product design and deployment.
2.	Apply essential front-end and back-end technologies to design, develop, and integrate user interfaces.
3.	Construct Django-based web applications by organizing projects, defining models, implementing views, and utilizing templates.
4.	Manage and extend Django applications by configuring the admin interface, processing forms, and employing advanced data handling techniques.
5.	Integrate advanced Django features and best practices to implement class-based views, user management, database operations, testing, and application security.

UNIT I Foundations of Modern Web Development **7 Hours**
1.1 State of the web (T1 Chapter 1): Rise of the web, mobile web, state of HTML, websites, and applications 1.2 Technology Stacks: Overview, MERN, MEAN, MEVN, MENG, LAMP, WAMP, XAMPP, Ruby on Rails stacks, Comparison of Stacks 1.3 Product Design (T1 Parts of Chapters 2 to 6, 8, 10-12): Requirements, Work Breakdown, User Experience Design, User Interaction Design, Systems Architecture, Component Interactions, Module Design, Design for Failures 1.4 Twelve Factor App Methodology (W01): Background, Twelve Factors 1.5 API Design (T1 Chapter 10 to 11, R4): API Responsibilities, Designing REST APIs, Securing APIs, Event-Based APIs, Discovering APIs, and Using APIs. 1.6 JQuery (T1 Chapter 8, R1, R2): Syntax, Selectors, Events, Effects, Traversing, AJAX

UNIT II Django Fundamentals and Core Components **8 Hours**
2.1 The MVT Design Pattern-The MVT Design Pattern- Django's History. Installation of Django: Installing Python- Installing Django-Setting up a Database – Starting a Project- the Development Server- Django Commands Overview. 2.2 Introduction to Django (T2 Chapter 3): Introduction, Feature Sets, Security, Scalability, Versatility, Applications, Project Structure 2.3 Django Models (T2 Chapter 4): Supported databases, defining models, Basic Data Access, Creating relationships

UNIT III Django Fundamentals and Core Components **8 Hours**
3.3 Django Views (T2 Chapter 5): Introductions, Configuring URLs, Dynamic Content, Dynamic URLs 3.4 Django Templates (T2 Chapter 6): Template System Basics, Design Philosophy, Template inheritance, Displaying database data, Loading Static Content, Template Includes

3.5 The Django Admin (T2 Chapter 7): Accessing admin site, Registering Models, Editing tables, Managing Users 3.6 Django Forms (T2 Chapter 8): Basics, Model Forms

UNIT IV Django Administration, Forms, and Advanced Data Handling 8 Hours
4.1 Advanced Models (T2 Chapter 9): Working with data, Methods that return QuerySets, Methods that do not return QuerySets, Field Lookups, Aggregate Functions, Model Methods, Model Inheritance 4.2 Advanced Views (T2 Chapter 10): Request and Response Objects, QueryDict objects, Template Response Objects, Middleware, Generating Non-HTML Content, Pagination 4.3 Advanced Templates (T2 Chapter 11): Tags, Filters, Handling invalid variables, Custom Tags, Custom Filters

UNIT V Advanced Django Features and Best Practices 8 Hours
5.1 Class Based Views (T2 Chapter 13): View, RedirectView and TemplateView, Customizing Generic View Classes and Methods, Django's Class-based Generic Views 5.2 Advanced User Management (T2 Chapter 14): The User Model Class, Creating a Custom User Model, Custom Authentication 5.3 Advanced Forms (T2 Chapter 15): Customizing Forms, The Messages Framework, Django Formsets, Handling Multiple Forms 5.4 Working with Databases (T2 Chapter 16): Database Management Commands, Connecting to Database Engines (PostgreSQL and MySQL) 5.5 Debugging and Testing (T2 Chapter 17): Using Django's Error Page, Using the Messages Framework, Unit Testing

LAB Component
1. Biodata website using Django 2. Using Django implement a program to accept USN, Name , subject code ,CIE marks and store information in a database and display students whose cie is less than 20 3. To accept student name, usn, semester ,exam fee from web page and delete all the students who have not paid exam fee 4. Using Django create a HR database with the collection employees having fields like employee name, email, phone, hired date, job title, salary. Accept this fields and store it in database and display all employees details whose salary is greater than 50k 5. Create an exam management system using Django framework for creating student database and displaying students who have secured “O”grade. 6. To implement in final year’s database which accepts usn ,name ,and company name as fields and store it in database. Display the list of students who are placed for Amazon . 7. Program to accept the fields id, title, name and branch of a faculty and store it in database. Display all the faculty who belong to CSE branch and the title is professor. 8. Consider the student information like name ,usn, dept ,grade fron a web page and store it in a database and update student grade with the name specified by the user and display the results 9. Using Django, perform CRUD operations for an employee detail.

Course Outcomes: On Successful completion of this course, students will be able to	
1.	Explain the foundational concepts and methodologies of modern web development and product design.
2.	Develop interactive web applications using front-end and back-end technologies, including HTML, CSS, JavaScript, and SQLite.
3.	Build robust web applications using Django, incorporating models, views, templates, and forms.
4.	Administer and enhance Django applications through advanced data handling, user

	management, and customization of the admin interface.
5.	Evaluate and apply advanced Django features, including class-based views, testing, debugging, and security measures, to deliver production-ready web solutions.

Sl. No	Title of the Book	Name of the Author/s	Name of the publisher	Edition & Year
Textbooks				
1	The Full Stack Developer ISBN: 978-1-4842-4151-6	Chris Northwood	Apress Media LLC	2018
2	**Mastering Django** ISBN:978-0648884415	Nigel George	GNW Independent Publishing	2020
Reference Books				
1	**HTML 5 Black Book**	DT Editorial Services	Dreamtech Press	2016
2	**JavaScript and JQuery: Interactive Front-End Web Development**	Jon Duckett	Wiley	1st Edition 2014
3	**SQLite3**	Vicente Hernando	McGraw Hill	1st Edition 2017
W1	https://www.12factor.net/			
W2	https://getbootstrap.com/			

Course Articulation Matrix (CO-PO and CO_PSO MAPPING)

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2		2										2	
CO2	2		2										2	
CO3			2										2	
CO4			2										2	
CO5			2										2	
Overall CO	2		2										2	

Program Articulation Matrix:

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	2		2										2	

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

REAL TIME BIG DATA ANALYTICS

Course Code	**S7CS01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	42 Hrs	Practical Hour	-

Course objectives: The course will enable students to

1. Describe the basic paradigms , data model , evolution for Big Data (L2)
2. Explain the importance of a serialization framework and limitations of serialization frameworks for Big Data (L2)
3. Analyze how the data is stored on the batch layer
4. Design of the batch layer starting from ingesting new data to computing batch views
5. Illustrate how to build the serving layer for Big data
6. Describe the real time views of Cassandra's data model for Big data
7. Demonstrate how to implement the concepts of queuing and stream processing using real-world tools...

UNIT-1 **(09 hrs)**

A new paradigm for Big Data: Scaling with a traditional database – No SQL is not a panacea - First principles - Desired properties of a Big Data system - The problems with fully incremental - Lambda Architecture - Recent trends in technology - Example application: SuperWebAnalytics.com.
Data model for Big Data: The properties of data - The fact-based model for representing data - Graph - A complete data model for SuperWebAnalytics.com.

UNIT-2 **(09 hrs)**

Data storage on the batch layer: Storage requirements for the master dataset - Choosing a storage solution for the batch layer - How distributed file systems work - Storing a master dataset with a distributed file system - Vertical partitioning - Low-level nature of distributed file systems - Storing the SuperWebAnalytics.com master dataset on a distributed file system
Batch layer: Computing on the batch layer, Re-computation algorithms vs. incremental algorithms, Scalability in the batch layer, MapReduce: a paradigm for Big Data computing, Low-level nature of MapReduce, Pipe diagrams: a higher-level way of thinking about batch computation

UNIT-3 **(08 hrs)**

Batch layer - Architecture and algorithms: Design of the SuperWebAnalytics.com batch layer - Workflow overview - Ingesting new data - URL normalization - User-identifier normalization - Deduplicate pageviews - Computing batch views
Batch layer: Implementation: Starting point - Preparing the workflow - Ingesting new data - URL normalization - User-identifier normalization - Deduplicate pageviews - Computing batch views

UNIT-4 **(09 hrs)**

Serving layer: Performance metrics for the serving layer - The serving layer solution to the normalization/denormalization problem - Requirements for a serving layer database - Designing a serving layer for SuperWebAnalytics.com - Contrasting with a fully incremental solution.
Realtime views : Computing realtime views - Storing realtime views - Challenges of incremental computation - Asynchronous versus synchronous updates - Expiring realtime views.

UNIT-5 **(09 hrs)**

Queuing and stream processing: Queuing, Stream processing, Higher-level, one-at-a-time stream processing, SuperWebAnalytics.com speed layer
Queuing and stream processing: Illustration: Defining topologies with Apache Storm, Apache Storm clusters and deployment, Guaranteeing message processing

Course outcomes:

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

1. Apply the basic knowledge related to Big data to explain its elements, its analytics, its usage in business context.
2. Illustrate data storage on the batch layer using the Hadoop Distributed File System
3. Design and develop batch layer to the solution of various real world application problems in the context of master data
4. Design and develop serving layer to the solution of various real world application problems in the context of master data
5. Design and develop speed layer considering the concepts of queuing and stream processing using real-world tools.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Big Data - PRINCIPLES AND BEST PRACTICES OF SCALABLE REAL-TIME DATA SYSTEMS	NATHAN MARZ with JAMES WARREN	Manning Publications	2015 Edition
2	Spark in Action	Petar Zečević Marko Bonaći	Manning Publications	Nov 2016 Edition
Reference Books				
1	Hadoop: The Definitive Guide	Tom White	O'reilly Media	4th Edition,2015
2	Big Data and Analytics	Seema Acharya, Subhashini Chellappan	Wiley India Publications,	May 2015
3	Big Data Black book	D T Editorial Services	Dream tech press	2016 Edition

Tutorial Component to be developed using PySpark
The fact-based model for representing data: Demonstrate the followings Setting up the pyspark shell Reading and ingesting data into a data frame Exploring data in the DataFrame structure Moving from a sentence to a list of words Reshaping and Filtering rows
Programs to work in batch mode: Demonstrate the following Grouping records: Counting word frequencies Writing data from a data frame Putting it all together: counting launch the program in batch mode
Analysing and processing tabular data : Demonstrate the following The most common operations on a data frame (selection, deletion, and creation or Columns), Summarizing data frame Joining two data frames together multi-dimensional data using compound types. Filling null values in your data frame
Use of SQL-like syntax within data frame methods: Creating a view in Spark SQL and in PySpark Unioning tables together in Spark SQL and in PySpark
Manipulating data the resilient distributed dataset (RDD) way: map, filter and reduce
Moving from large data sets in PySpark to small summaries in pandas for assessment: Exploring data and getting first feature columns

Addressing data mishaps and building first feature set
Getting data set ready for assembly: null imputation and casting

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAMME OUTCOMES											PSO		
	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	PSO3
CO1	3													2
CO2					2									2
CO3			3											3
CO4		2			2									2
CO5					2									2
Overall CO	3	2	3	-	2	-	-	-	-	-	-	-	-	3

Program articulation matrix:

Course	PROGRAMME OUTCOMES											PSO		
	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	PSO3
BIG DATA	3	2	3	-	2	-	-	-	-	-	-	-	-	3

Degree of compliance **1**: Low **2**: Medium **3**: High

B.E COMPUTER SCIENCE & ENGINERRING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

DEEP LEARNING

Course Code	**S7CSPE01**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	3	Exam Hours	03
Lecture Hours	42 Hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. Learn deep learning methods for working with sequential data
2. Learn deep recurrent and memory networks
3. Apply deep learning mechanisms to various learning problems.
4. Learn various performance metrics to evaluate deep learning models and apply the same to real world problems..

UNIT-1 **(8 hrs)**

What is deep learning: Artificial intelligence, machine learning, and deep learning, Brief history of machine learning, Why deep learning?, Data representation for neural network, the gears of neural network: Tensor operation, the engine of neural networks: gradient based optimization.

UNIT-2 **(8 hrs)**

Introduction to Keras and Tensorflow: Whats Tensorflow, Whats Keras, Keras and Tensorflow: a brief history, first step with Tensorflow, Anatomy of neural network: Understanding core Keras APIs.

UNIT-3 **(8 hrs)**

Getting started with neural networks: classification and regression, classifying movie reviews: A binary classification example, Classifying new wires: A multi class classification, predicting house prices: A regression example. Generalisation: The goal of machine learning, evaluating machine learning models, improving model fit, improving generalisation.

UNIT-4 **(8 hrs)**

Introduction to deep learning for computer vision: Introduction to Convnets, training a convent from scratch on a small dataset, leveraging a pretrained model, advanced deep learning for computer vision: Three essential computer vision tasks, modern convent architecture patterns, interpreting what convnets learn.

UNIT-5 **(8 hrs)**

Deep learning for Time series: Different types of time series tasks, a temperature forecasting example, understanding RNN, advanced use of RNNs, NLP: the bird eye view, Generative deep learning, text generation: deep dream, neural style transfer, generating images with variational auto encoders, introduction to generative adversarial networks. Best practices for the real world: getting the most out of your models, scaling up model training.

Course outcomes:

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

1. Describe basic concepts of neural network, its applications and various learning models
2. Acquire the knowledge on Recurrent, Recursive Nets
3. Analyze different Network Architectures, learning tasks, Convolutional networks
4. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
5. Analyze performance of deep learning techniques

Sl. no.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Deep Learning with Python	François Chollet	Manning Publications	2nd Edition, Co, ISBN: 9781617296864
2	Deep Learning for Coders with fastai & PyTorch	Jeremy Howard & Sylvain Gugger	O'reilly	ISBN:978-1-492-04552-6
Reference Books				
1	Neural Networks – A Comprehensive Foundation	Simon Haykins	Simon Haykin	2 nd edition, PHI, 2005, ISBN10: 0120983855
2	Deep Learning (Adaptive Computation and Machine Learning Series)	Ian Good Fellow, Yoshua Bengio and Aaron	Ian Good Fellow, Yoshua Bengio and Aaron Courville.	1st edition, MIT Press, 2017, ISBN-13: 978-0262035613
3	Introduction to Artificial Neural Networks	Gunjan Goswami, S.K. Kataria & Sons	Gunjan Goswami, S.K. Kataria & Sons	1 st Edition, 2012, ISBN-13: 978-9350142967.
4	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms	Nikhil Buduma	Nikhil Buduma O'Reilly Publications,	1st Edition, 2016, ISBN-13: 978-1491925614.

Course articulation matrix(CO-PO and CO-PSO mapping)

Course Outcome	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2											2	
CO2	2	2												2	
CO3	2		2											2	
CO4	2	2												2	
CO5	2				2									2	

Program articulation matrix:

Course Outcomes	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
	2	2	2		2									2	

B.E COMPUTER SCIENCE & ENGINEERING

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – VII

GENERATIVE AI AND PROMPT ENGINEERING

Course Code	**S7CSPE02**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	42 Hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. To provide a comprehensive understanding of generative AI models and their applications.
2. To explore the key components and workings of LangChain and its comparison with other frameworks.
3. To develop skills for building and implementing chatbots using advanced retrieval and vector techniques.
4. To introduce the fundamentals and importance of prompt engineering in AI communication.
5. To equip students with best practices and strategies for writing effective prompts and addressing common challenges in prompt engineering.

UNIT-1 **9 Hours**

Introducing generative AI: Generative models, Understanding LLMs, What is a GPT?, Other LLMs, Major players, Working of GPT models, Pre-training, Tokenization, Scaling, Conditioning, text-to-image models, LangChain for LLM Apps: Going beyond stochastic parrots, limitations of LLMs, mitigating LLM limitations, LLM app, LangChain.

UNIT-2 **8Hours**

Exploring key components of LangChain, chains, agents, memory, tools, working of LangChain, Comparing LangChain with other frameworks, Summarizing information, Basic prompting Prompt templates, Building a Chatbot like ChatGPT: What is a chatbot?, Understanding retrieval and vectors, Embeddings, Vector storage, Vector indexing, Vector libraries, Vector databases, Loading and retrieving in LangChain, Document loaders, Retrievers in LangChain, kNN retriever, PubMed retriever, Custom retrievers.

UNIT-3 **9Hours**

Implementing a chatbot, Document loader, Vector storage, Memory, LLMs for Data Science, The impact of generative models on data science, Automated data science, Data collection, Visualization and EDA, Preprocessing and feature extraction, The Future of Generative Models, The current state of generative AI, Challenges, Trends in model development, Artificial General Intelligence, Economic consequences, Creative industries and advertising, Education, Law, Manufacturing, Medicine, Military, Societal implications.

UNIT-4 **8 Hours**

Introduction to ChatGPT, Overview of Large Language Models, Output Formats Generated By ChatGPT, Use Cases for ChatGPT, Differences Between ChatGPT and Web Search, Introduction to Prompt Engineering:

Definition of Prompt Engineering, Importance of Prompt Engineering in AI Communications, Overview of the Different Types of Prompts, Understanding the Foundation of Prompt Engineering, Power Up Your Prompts With Effective Verbs, Elevate Your Prompts with Nuances of Tone, Progressive Experimentation for Refining Prompts, Do You Need Programming Skills to Become a Prompt Engineer?

UNIT-5	**8 Hours**
Writing Effective Prompts, Key Attributes of Good Prompt Writing, Tips for Getting the Most Out of Prompt Responses, Best Practices in Prompt Engineering: Understanding the Nuances of Language & Tone, Testing & Iterating Prompts for Improved Performance, Incorporating Feedback from AI Models to Refine Prompts, Enhancing Reliability of Responses, Give More "Think Time" to the Model, Staying Up to Date with the Latest Advancements, Tips for Getting the Most Out of Prompt Responses, Challenges in Prompt Engineering: Addressing Common Challenges & Pitfalls, Strategies for Improving Prompt Effectiveness, Ethical Considerations in Prompt Engineering.	

Course outcomes:

At the end of the course the student will be able to:

CO1: Gain a solid understanding of generative AI models, including large language models and text-to-image models.

CO2: Utilize LangChain for developing advanced LLM applications and understand its components and functionalities.

CO3: Develop practical skills in implementing chatbots, managing vector storage, and employing LLMs for data science.

CO4: Understand the principles of prompt engineering and learn how to design effective prompts for various AI applications.

CO5: Apply best practices in prompt engineering, address challenges, and incorporate ethical considerations in their work.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module.

Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbook				
1	Generative AI with LangChain	Ben Auffarth	Packt Publishing Ltd.	1st Edition, 2023
2	Demystifying Prompt Engineering	Harish Bhat	Harish Bhat	1st Edition, 2023
Reference Books				
1	"Generative Deep Learning: Teaching Machines to Paint, Write,	David Foster	O'Reilly Media	2nd Edition, 2023
2	Prompt Engineering for Generative AI: Future-Proof Inputs for Reliable AI Outputs	James Phoenix, Mike Taylor	O'Reilly Media	1st Edition, 2024

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAM OUTCOMES											PSO		
	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	PSO3
CO1	2												2	
CO2			2										2	
CO3			2										2	
CO4			2		2								2	
CO5	2				2								2	
Overall CO	2		2		2								2	

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

NATURAL LANGUAGE PROCESSING

Course Code	**S7CSPE03**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	40 Hrs	Practical Hour	-

Course objectives: The course will enable students to

1. To Understand the NLP techniques like parsing, POS-tagging and Word sense disambiguation.
2. To explore language modeling techniques such as N-grams.
3. To explore the applications of NLP such as Machine translation, Information retrieval etc.
4. To understand the basic architecture of the NLG system and the role of NLP in a search engine.
5. Demonstrate the use of modern NLP techniques for processing of text like extracting the data. Text to Feature representation etc....

UNIT-1 **(08 hrs)**

Introduction to NLP: NLP in the Real-world, NLP Tasks, what is Language: Building Blocks of Language, Why NLP is Challenging, Machine Learning, Deep Learning, and NLP: An Overview, Approaches to NLP: Heuristic based NLP, Machine Learning for NLP, Deep Learning for NLP, Why Deep Learning is not Yet the Silver Bullet for NLP, An NLP Walkthrough: Conversational Agents.
NLP Pipeline: Data Acquisition, Text Extraction and Cleanup: HTML Parsing and Cleanup, Unicode Normalization, Spelling Correction, System-Specific Error Correction, Pre-Processing: Preliminaries, Frequent Steps, Other Pre-Processing Steps, Advanced Processing, Feature Engineering, Modeling, Evaluation, Post-Modeling Phases, Working with Other Languages, Case Study. **Extracting the Data:** Text data collection using APIs, Reading PDF file in Python, Reading word document, Reading JSON object, Regular expressions. **Exploring and Processing Text Data:** Lowercasing, Punctuation removal, Stop words removal, Text standardization.
(Text Book-1: 1,2)
(Text Book-2: Recipe 1.1-1.6, Recipe 2.1-2.4)
(Text Book-4: 3.4, 3.5, 3.7)

UNIT-2 **(08 hrs)**

Language Modeling: Introduction, Statistical Language Model- N-gram model, Add-one smoothing, Good-Turing smoothing. Generating N-grams. **Part-of-Speech Tagging**: Rule-based Tagger, Stochastic Tagger, Hybrid Tagger. Tagging Part of Speech. **Syntactic Analysis**: CFG, Parsing- Top-down parsing, Bottom-up parsing, Probabilistic Parsing- Estimating Rule probabilities. Recursive Descent Parsing, Shift-Reduce Parsing, The Left-Corner Parser, Dependencies and Dependency Grammar. **Tokenizing Text and WordNet Basics:** Introduction, Tokenizing text into sentences, Tokenizing sentences into words, Tokenizing sentences using regular expressions, training a sentence tokenizer, Filtering stop words in a tokenized sentence, Looking up Synsets for a word in WordNet, looking up lemmas and synonyms in WordNet, Calculating WordNet Synset similarity, Discovering word collocations.
(Text Book-3: 2.3.1, 2.3.2, 2.3.3, 3.7.1, 3.7.2, 3.7.3, 4.2, 4.4.1, 4.4.2)
(Text Book-2: Recipe 4-3. Recipe 3-3)
(Text Book-4: 8.4, 8.5)
(Text Book-5: 1)

UNIT-3 **(08 hrs)**

Information Retrieval: Introduction, Design features of Information Retrieval Systems, Information Retrieval models, Classical Information Retrieval models, Alternative models of IR, Evaluation of the IR system. **Cross-Lingual Information Retrieval. Converting Text to Features:** One Hot encoding, Count vectorizer, Co-occurrence matrix, Hash vectorizer, Word embedding, Implementing

fastText. **Information retrieval using word embeddings.**
(Text Book-3: 9.1-9.4,9.6.1-9.6.2,9.7,10.6)
(Text Book-2: Recipe 3.1-3.2,3.4-3.8)

UNIT-4 **(08 hrs)**

Ambiguity, Word sense Disambiguation: Knowledge based approaches, Supervised Learning of WSD. **Disambiguating Text.**
Text Classification: Applications, A Pipeline for Building Text Classification Systems, A Simple Classifier Without the Text Classification Pipeline, Using Existing Text Classification APIs, One Pipeline, Many Classifiers, Naive Bayes Classifier, Logistic Regression, Support Vector Machine, Using Neural Embeddings in Text Classification, Word Embeddings, Subword Embeddings and fastText, Document Embeddings, Deep Learning for Text Classification, CNNs for Text Classification,
LSTMs for Text Classification, Text Classification with Large, Pre-Trained Language Models, Interpreting Text Classification Models, Explaining Classifier Predictions with Lime, Learning with No or Less Data and Adapting to New Domains, No Training Data, Less Training Data: Active Learning and Domain Adaptation, Case Study: Corporate Ticketing.
Machine Translation: Introduction, Problems in Machine Translation, Machine translation approaches, Direct Machine translation, Rule-based machine translation, Corpus based MT.
(Text Book-3: 5.4.1,5.5.2,8.1-8.7)
(Text Book-1: 4)
(Text Book-2: Recipe 4.8)

UNIT-5 **(08 hrs)**

Information Extraction: IE Applications, IE Tasks, The General Pipeline for IE, Keyphrase Extraction, Implementing KPE, Named Entity Recognition, Building an NER System, NER Using an Existing Library, NER Using Active Learning, Named Entity Disambiguation and Linking, NEL Using Azure API.
Topic Modeling, Text Summarization, Recommender Systems for Textual Data, Question-Answering System.
Applied NLP: NLP in a Search Engine, Social Media: Applications, Unique Challenges, NLP for Social Data, Word Cloud, Tokenizer for SMTD, Trending Topics, Understanding Twitter Sentiment, Pre-Processing SMTD, Text Representation for SMTD, Customer Support on Social Channels, Memes and Fake News.
(Text Book-3: 11.4)
(Text Book-1: 5,8,7)
(Text Book-2: Recipe 5.6)

Course outcomes:

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

1. **Outline** the fundamental concepts of Natural Language Processing and **Apply** text data acquisition techniques and perform basic text preprocessing using Python.
2. **Outline** the basic NLP tasks like N-gram language modelling, POS tagging, Parsing, Tokenization and WordNet based synset similarity and explore the same using python libraries.
3. **Identify** the various text to feature representation methods and their usage using python libraries and **apply** the same to develop various information retrieval models.
4. **Outline** various applications of NLP like Machine Translation, information extraction, etc. explore the same using python libraries

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, and Harshit	O'Reilly	June 2020: First Edition
2	Natural Language Processing Recipes Unlocking Text Data with Machine Learning and Deep Learning using Python	Akshay Kulkarni, Adarsha Shivananda.	Apress	2019
3	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U S Tiwary	Oxford University Press	2nd Edition, 2010.
4	Natural language processing with Python	Steven, Ewan Klein, and Edward Loper	O'Reilly Media	1st Edition, 2009.
5	Python 3 Text Processing with NLTK 3 Cookbook	Jacob Perkins	PACKT	Second edition: August 2014
Reference Books				
1	Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition,	Daniel Jurafsky and James H Martin	Prentice Hall,,	Low Price Edition, 2000.
2	Foundations of Statistical Natural Language Processing	Christopher D. Manning	MIT Press	1999.

Course Articulation matrix(CO-PO and CO-PSO mapping)

Course Outcomes	PROGRAMME OUTCOMES											PSO		
	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	PSO3
CO1	2		2		2								2	
CO2	2		2		2								2	
CO3	2		2		2								2	
CO4	2		2		2								2	
CO5	2		2		2								2	
Overall CO	2		2		2								2	

Program Articulation Matrix:

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1,CO2,CO3,CO4	**2**		**2**		**2**								**2**	

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

QUANTUM COMPUTING

Course Code	**S7CSPE04**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	42 Hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. To acquire the basics of Mathematics and Physics for Quantum Computing.
2. To understand the concepts behind building a Programmable Quantum Computer.
3. To analyse the mechanism of quantum data processing and the cryptographic techniques involved.
4. To compare classical solutions and quantum solutions for certain defined problems

UNIT-1 **(08 hrs)**

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers.

UNIT-2 **(08 hrs)**

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.
Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD,Quantum Entanglement, Interpretation, QKE

UNIT-3 **(08 hrs)**

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials

UNIT-4 (08 hrs)

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT-5 (08 hrs)

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

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

1. Explain the concepts of Quantum Computing with necessary Mathematics and Physics principles.
2. Analyse how a Quantum Computer is built.
3. Illustrate the quantum data processing and cryptographic techniques.
4. Analyse the Impact of Quantum Computing on Cryptography

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Quantum Computing Fundamentals	Dr. Chuck Easttom	Pearson	Second and 2024
2	Quantum Computing from the Ground Up	Riley Tipton Perry	World Scientific publishing Company	5th Edition,2012
Reference Books				
1	Quantum Computing. Oxford	P. Kaye, R. Laflamme,M. Mosca.	Oxford Press	1st Edition, 2007.
2	Quantum Computation and Quantum	M. A. Nielsen I. L Chuang.	Cambridge University Press	10th Edition,2010

Course Articulation Matrix (CO-PO and CO_PSO MAPPING)

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2		2									2	2	
CO2		2	2									2	2	
CO3			2									2	2	
CO4	2	2										2	2	
Overall CO	2	2	2									2	2	

Program Articulation Matrix:

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	2	2	2									2	2	

B.E COMPUTER SCIENCE & ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII

AGENTIC AI – FOUNDATIONS AND APPLICATIONS

Course Code	**S7CCSPE03**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Exam Hours	03
Lecture Hours	42 hrs	Practical Hour	-

Course objectives: This course will enable students to:

1. Understand the foundations and evolution of agentic AI and its differences from traditional AI.
2. Learn agent architectures and environmental characteristics for effective agent system design.
3. Analyze and implement communication and coordination strategies in multi-agent systems.
4. Understand learning paradigms in agentic AI to design adaptive agents.
5. Familiarize with ethical, security, and technological challenges in advanced agentic AI.

UNIT-1 **(09 hrs)**

Introduction to Agentic AI :

1.1 : Foundations of AI

1.1.1 : History and Evolution of AI (References: T1: Ch.1, Sec.1.2; R1: Ch.1, Sec.1.1; W1)
1.1.2 : Definitions and Approaches to AI (References: T1: Ch.1, Sec.1.1; R1: Ch.1, Sec.1.2; W2)

1.2 : Agent Paradigm

1.2.1 : Definition of an Agent (References: T1: Ch.2, Sec.2.1; T2: Ch.2, Sec.2.1; W3)
1.2.2 : Types of Agents (References: T1: Ch.2, Sec.2.4; T2: Ch.2, Sec.2.2; W4)

1.3 : Agentic AI vs Traditional AI

1.3.1 : Autonomy and Proactivity (References: T1: Ch.2, Sec.2.3; T2: Ch.2, Sec.2.3; W5)
1.3.2 : Goal-Directed Behaviour (References: T1: Ch.2, Sec.2.4.3; T2: Ch.2, Sec.2.4; W6)

1.4 : Applications of Agentic AI

1.4.1 : Real-world Examples (References: T1: Ch.1, Sec.1.4; T2: Ch.1, Sec.1.2; W7)

UNIT-2 **(07 hrs)**

Agent Architectures and Environments :

2.1 : Agent Architectures

2.1.1 : Simple Reflex Agents (References: T1: Ch.2, Sec.2.4.1; T2: Ch.2, Sec.2.2; W8)
2.1.2 : Model-based Reflex Agents (References: T1: Ch.2, Sec.2.4.2; T2: Ch.2, Sec.2.2; W9)
2.1.3 : Goal-based Agents (References: T1: Ch.2, Sec.2.4.3; T2: Ch.2, Sec.2.2; W10)
2.1.4 : Utility-based Agents (References: T1: Ch.2, Sec.2.4.4; T2: Ch.2, Sec.2.2; W11)
2.1.5 : Learning Agents (References: T1: Ch.2, Sec.2.4.5; T2: Ch.2, Sec.2.2; W12)

2.2 : Environments for Agents

2.2.1 : Properties of Environments (References: T1: Ch.2, Sec.2.3; T2: Ch.2, Sec.2.3; W13)
2.2.2 : Environment Types (PEAS) (References: T1: Ch.2, Sec.2.3; T2: Ch.2, Sec.2.3; W14)
2.2.3 : Environment Modeling (References: T1: Ch.2, Sec.2.3; R1: Ch.2, Sec.2.2; W15)

UNIT-3 **(09 hrs)**

Agent Communication and Coordination:

3.1 : Agent Communication

3.1.1 : Communication Languages (References: T2: Ch.6, Sec.6.2; R1: Ch.13, Sec.13.2; W16)
3.1.2 : Speech Acts and Semantics (References: T2: Ch.6, Sec.6.3; R1: Ch.13, Sec.13.3; W17)
3.1.3 : Agent Communication Protocols (References: T2: Ch.6, Sec.6.4; R1: Ch.13, Sec.13.4; W18)

3.2 : Coordination in Multi-Agent Systems

3.2.1 : Coordination Strategies (References: T2: Ch.7, Sec.7.1; R1: Ch.13, Sec.13.5; W19)
3.2.2 : Distributed Problem Solving (References: T2: Ch.7, Sec.7.2; R1: Ch.13, Sec.13.6; W20)
3.2.3 : Negotiation and Conflict Resolution (References: T2: Ch.7, Sec.7.3; R1: Ch.13, Sec.13.7; W21)

3.3 : Applications of Agent Communication and Coordination

3.3.1 : Real-world Multi-Agent Systems (References: T2: Ch.1, Sec.1.2; R1: Ch.1, Sec.1.3; W22)

UNIT-4 (08 hrs)

Learning in Agentic AI :

4.1 : Introduction to Learning in Agents

4.1.1 : Need for Learning in Agents (References: T1: Ch.2, Sec.2.4.5; R1: Ch.20, Sec.20.1; W23)

4.1.2 : Types of Learning (References: T1: Ch.18, Sec.18.1; R1: Ch.20, Sec.20.2; W24)

4.2 : Supervised and Unsupervised Learning

4.2.1 : Supervised Learning (References: T1: Ch.18, Sec.18.2; R1: Ch.20, Sec.20.3; W25)

4.2.2 : Unsupervised Learning (References: T1: Ch.18, Sec.18.3; R1: Ch.20, Sec.20.4; W26)

4.3 : Reinforcement Learning

4.3.1 : Reinforcement Learning Basics (References: T1: Ch.21, Sec.21.1; R1: Ch.21, Sec.21.1; W27)

4.3.2 : Q-Learning and Policy Learning (References: T1: Ch.21, Sec.21.3; R1: Ch.21, Sec.21.2; W28)

4.4 : Integration of Learning in Agent Architectures

4.4.1 : Learning Agents (References: T1: Ch.2, Sec.2.4.5; T2: Ch.2, Sec.2.2; W29)

4.4.2 : Applications of Learning Agents (References: T1: Ch.25, Sec.25.1; T2: Ch.1, Sec.1.2; W30)

UNIT-5 (07 hrs)

Advanced Topics in Agentic AI

5.1 : Ethical and Social Issues

5.1.1 : Ethics in Agentic AI (References: T1: Ch.27, Sec.27.1; R1: Ch.26, Sec.26.1; W31)

5.1.2 : Social Impact and Responsibility (References: T1: Ch.27, Sec.27.2; R1: Ch.26, Sec.26.2; W32)

5.2 : Explainability and Transparency

5.2.1 : Explainable Agentic Systems (References: T1: Ch.27, Sec.27.3; R1: Ch.26, Sec.26.3; W33)

5.2.2 : Human-Agent Interaction (References: T1: Ch.27, Sec.27.4; T2: Ch.10, Sec.10.2; W34)

5.3 : Security and Robustness

5.3.1 : Security Challenges in Agentic AI (References: T1: Ch.27, Sec.27.5; R1: Ch.26, Sec.26.4; W35)

5.3.2 : Robustness and Safety (References: T1: Ch.27, Sec.27.6; R1: Ch.26, Sec.26.5; W36)

5.4 : Integration with Emerging Technologies

5.4.1 : Agentic AI and IoT (References: T1: Ch.25, Sec.25.3; T2: Ch.11, Sec.11.2; W37)

5.4.2 : Agentic AI in Cloud and Edge Computing (References: T1: Ch.25, Sec.25.4; T2: Ch.11, Sec.11.3; W38)

5.5 : Future Directions

5.5.1 : Research Trends in Agentic AI (References: T1: Ch.28, Sec.28.1; R1: Ch.27, Sec.27.1; W39)

5.5.2 : Open Challenges (References: T1: Ch.28, Sec.28.2; R1: Ch.27, Sec.27.2; W40)

Course outcomes:

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

1. Explain the foundational concepts and evolution of agentic artificial intelligence.
2. Identify and design appropriate agent architectures and model agent environments.
3. Implement communication and coordination strategies in multi-agent systems.
4. Apply learning algorithms to develop adaptive and intelligent agents.
5. Analyze and address ethical, security, and technological challenges in advanced agentic AI applications.

Sl. No	Title of the Book	Name of the Author/s	Name of the publisher	Edition & Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson	4th, 2021
2	An Introduction to MultiAgent Systems	Michael Wooldridge	Wiley	4th, 2021
Reference Books				
1	Artificial Intelligence: Foundations of Computational Agents	David Poole, Alan Mackworth	Cambridge University Press	2nd,2017

Course Articulation Matrix (CO-PO and CO_PSO MAPPING)

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2		2										2	
CO2			2										2	
CO3			2										2	
CO4			2										2	
CO5	2		2										2	
Overall CO	2		2										2	

Program Articulation Matrix:

Course Outcomes	Program Outcomes											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
	2		2										2	