BE SCHEME & SYLLABUS

Fourth Year
(VII and VIII Semester)

With effect from 2022-23

Computer Science and Engineering

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R &D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.

ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution

Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi

NBA – Accredited: B.E. (ECE,EEE, ME and CIV) & PG (MBA and MCA)

NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS

(With effect from 2022-23)

Computer Science and Engineering

FOURTH YEAR

(VII and VIII Semester)

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Four of the UG programs, namely Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and two of the PG programs, namely MBA and MCA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

CONTENTS

ABOUT THE DEPARTMENT

The Department of Computer Science and Engineering was setup during the inception of the college in 2002. The primary objective of this program is to prepare students for successful careers in Computer and Information technology industry that meet the needs of Indian and multinational organizations. The

Department started Research program in the year 2011. Currently, the student intake is 180 at the UG level. The program involves wide variety of courses which enable the students to formulate, solve and

analyze computer engineering problems, prepare them for graduate studies and develop the ability to synthesize data and technical concepts for application design & implementation of real time software products. The faculty of the Department are actively involved in teaching and research with specializations in Cloud Computing, Image Processing, Process Mining, Natural Language Processing

and Soft & Evolutionary Computing. The Department was accredited by NBA for 2 years from June 2013 to May 2015, for six years from July 2016 to June 2022 and is reaccredited by NBA for three years from July 2022 to June 2025. The Department has received a grant of Rs. 19 lakhs from AICTE for setting up Center of Excellence in Augmented Reality and Virtual Reality (AR/VR) under MODROBS 2020-21 scheme.

DEPARTMENT VISION

• To be recognized as a centre of excellence in computer and allied areas with quality learning and research environment.

DEPARTMENT MISSION

• Prepare competent professionals in the field of computer and allied fields enriched with ethical values.

• Contribute to the socio-economic development of the country by imparting quality education in Computer and Information Technology.

• Enhance employability through skill development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Apply Engineering Fundamentals: To impart to students a sound foundation and ability to Apply engineering fundamentals, mathematics, science and humanities necessary to formulate, analyze, design and implement engineering problems in the field of computer science.

PEO 2: Work in CS and allied fields: To develop in students the knowledge of fundamentals of computer science and engineering to work in various related fields such as network, data, web and system engineering.

PEO 3: Teamwork: To develop in students the ability to work as a part of team through effective communication on multidisciplinary projects.

PEO 4: Successful Career: To train students to have successful careers in computer and information technology industry that meets the needs of society enriched with professional ethics.

PEO 5: Higher Education: To develop in students the ability to pursue higher education and engage in research through continuous learning.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and the synthesis of information to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and The World: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO9: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO10: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and a leader in a team, to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Apply knowledge of Data Structures and Algorithms to develop effective programs.

2. Design and develop solutions using principles of Computer Networks, Database concepts, Web Based tools and Software engineering.

VII Semester (B.E. – Computer Science and Engineering)													
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical /Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	IPCC	22CSE71	Cryptography and Network Security	CSE	CSE	3	-	2	03	50	50	100	4
2	IPCC	22CSE72	High Performance Computing	CSE	CSE	3	-	2	03	50	50	100	4
3	PCC	22CSE73	Cloud Computing	CSE	CSE	3	-	-	03	50	50	100	3
4	PEC	22CSE74X	Professional Elective -III	CSE	CSE	3	-	-	03	50	50	100	3
5	PRJ	22CSE75	Major Project Phase II	CSE	CSE	-	-	6	03	50	50	100	6
					Total	**12**	**-**	**10**	**15**	**250**	**250**	**500**	**20**

22MEC74X: Professional Elective III			
22CSE741	Natural Language Processing	22CSE743	Business Analytics
22CSE742	Deep Learning	22CSE744	UNIX System Programming

VIII Semester (B.E. - Computer Science and Engineering)														
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	PEC	22CSE81	Professional Elective IV (Online Course)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester.								100	3
2	OEC	22CSE82	Open Elective -II (Online Course)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester.								100	3
3	INT	22CSE83	Research / Industry Internship (14 to 16 weeks)			-	-	-	03	50	50	100	10
					Total	**-**	**-**	**-**	**03**	**50**	**50**	**300**	**16**

Note: a. Professional Elective IV : These are ONLINE courses suggested by the Board of Studies.

b. Open Elective -II : These are ONLINE courses suggested by the Board of Studies.

c. During 4th year of the program i.e., after VII semester, students shall take up the **Research Internship /Industrial Internship for 14-16 weeks**. Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

VII Semester

Cryptography and Network Security			
Course Code	**22CSE71**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	Exam Hours	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives:

- Understand the fundamentals of cryptographic techniques
- Analyze and apply modern cryptographic algorithms
- Evaluate cryptographic data integrity mechanisms
- Implement security protocols for secure communication

Module-1 Symmetric Ciphers (8 hours)

Classical encryption techniques: Symmetric Cipher Model, Substitution techniques, Transposition techniques.

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES

Text book 1: Chapter 3.1 - 3.3, 4.1 - 4.4

Module-2 Asymmetric Ciphers (8 hours)

Principles of public key crypto systems: Principles of Public-Key Cryptosystems, Applications for Public-Key Cryptosystems Requirements for Public-Key Cryptosystems, Public-Key Cryptanalysis.

The RSA algorithm: Description of the Algorithm, Computational Aspects, The security of RSA.

Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange, The algorithm, Key exchange protocols, Man in the middle attack, Elgamal Cryptographic systems.

Text book 1: Chapter 9.1, 9.2, 10.1,10.2

Module-3 Cryptographic Data Integrity Algorithms (8 hours)

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Secure Hash Algorithm (SHA)

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions. MACs Based on Hash Functions: HMAC

Digital Signatures: Digital Signatures, El Gamal Digital Signature Techniques.

Text book 1: Chapter 11.1, 11.2, 11.4, 12.1, 12.2, 12.5, 13.1, 13.2

Module-4 Transport Layer Security, Wireless Network Security (8 hours)

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview-The Wi-Fi Alliance, IEEE 802 Protocol Architecture

Text book 1: Chapter 17.1-17.4, 18.1-18.3

Module-5 Electronic Mail Security, IP Security (8 hours)

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload

Text book 1: Chapter 19.1-19.4, 20.1-20.3

PRACTICAL MODULE

PART – A

Programming Assignments:

Implement the Caesar Cipher encryption and decryption algorithm in Java, allowing users to input a plaintext message and a shift value to encrypt and decrypt the text.

Implement the DES algorithm in Java, allowing users to input a plaintext message and perform encryption and decryption.

Write a Java program to perform RSA encryption and decryption for the given plain text message

Implement the Diffie-Hellman Key Exchange algorithm in Java, allowing two users to securely generate a shared secret over an insecure communication channel.
Implement the ElGamal Digital Signature Algorithm in Java, allowing users to generate keys, sign a message, and verify the signature.

PART – B

Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
Configure S/MIME and show email-authentication.

PART – C
(Demonstration)

Write a Java program to compute the Greatest Common Divisor (GCD) of two positive integers using the Euclidean Algorithm.
Write a Java program to find a primitive root modulo a given prime number.
Write a Java program to compute a^b mod m using Modular Exponentiation (Fast Exponentiation).

PART D
(Open Ended Problems)

Implement the Elliptic Curve Cryptography (ECC) encryption algorithm in Java, allowing users to input a plaintext message and use ECC for secure encryption and decryption.
Implement the SHA-256 (Secure Hash Algorithm) in Java, allowing users to input a plaintext message and generate its cryptographic hash.

Course Outcomes: At the end of the course the student will be able to:	
22CSE71.1	Apply substitution and transposition techniques and analyze the principles of block ciphers, including DES.
22CSE71.2	Develop secure communication using RSA, Diffie-Hellman key exchange, and ElGamal cryptographic systems.
22CSE71.3	Utilize SHA algorithms, message authentication codes, and digital signatures to ensure data integrity and authenticity.
22CSE71.4	Examine network communications using TLS, HTTPS, SSH, and wireless security protocols.
22CSE71.5	Demonstrate email security mechanisms to counter threats and configure secure email protocols like S/MIME within the Internet Mail Architecture.
22CSE71.6	Summarize the traffic processing functions performed by IPsec for Outbound packets and for inbound packets

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Cryptography and Network Security	William Stallings	Pearson Education	8th Edition, 2023
Reference Books				
1	Cryptography and Network Security.	Behrouz A. Ferouzan, Debdeep Mukhopadhyay,	Tata McGraw Hill.	3rd Edition, 2015
2	Introduction to Security and Network Forensics	Buchanan, William J.	CRC Press	1st Edition, 2011
3	Security in Computing	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies	Prentice Hall, New Delhi	5th Edition, 2015

Web links and Video Lectures (e-Resources):

- **Symmetric and Asymmetric Cryptography** - Professor Messer IT Certification - https://www.professormesser.com/security-plus/sy0-601/sy0-601-video/symmetric-and-asymmetric-cryptography/
- **RSA Algorithm** - https://learn.saylor.org/mod/page/view.php?id=80724.
- **Diffie-Hellman** - https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/
- **SSH vs SSL/TLS** - https://www.ssl2buy.com/wiki/ssh-vs-ssl-tls
- **ECC - Elliptic Curve Cryptography Dan Boneh, Stanford** University - https://crypto.stanford.edu/~dabo/cs255/lectures/ECC.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE71.1	3	2	1								1		2
22CSE71.2	3	2	1								1		2
22CSE71.3	3	2	1								1		2
22CSE71.4	1	2	2		1						1		2
22CSE71.5	1	2	2		1						1		2
22CSE71.6	1	2	2		1						1		2

1: Low 2: Medium 3: High

High Performance Computing			
Course Code	**22CSE72**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	Exam Hours	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives:

- To introduce the concepts of Modern Processors.
- To understand Optimization techniques for serial code.
- To discuss Parallel Computing Paradigms.
- To implement Parallel Programming using OpenMP,MPI and CUDA

Module-1 Introduction to High Performance Computing (08 hours)

Modern Processors: Stored Program Computer Architecture. General purpose cache-based microprocessor: Performance based metrics and benchmarks, Moore's Law, Pipelining, Superscalar, SIMD. Memory Hierarchies: Cache, Cache mapping, prefetch. Multicore processors- Multithreaded processors. Vector Processors: Design Principles, Maximum performance estimates, Programming for vector architecture

Textbook 1: Chapter 1.1 -1.6

Module-2 Parallel Computers and Parallelization (08 hours)

Parallel Computers: Taxonomy of parallel computing paradigms. Shared memory computers: Cache coherence,UMA ,ccNUMA. Distributed memory computers. Hierarchical (hybrid) systems.

Basics of parallelization: Why parallelize, Data Parallelism, Function Parallelism. Parallel Scalability: Factors that limit parallel execution, Scalability metrics, Simple scalability laws, parallel efficiency

Textbook 1: Chapter 4.1-4.4, Chapter 5.1-5.3(5.3.1 -5.3.4)

Module 3- Shared-memory parallel programming with OpenMP (08 hours)

Shared memory parallel programming with OpenMP: Introduction to OpenMP. The OpenMP model. Compiling and running OpenMP Programs, Thread data, Creating Parallelism, Nested parallelism, Loop parallelism, Reductions, Nested loops, Synchronization- Barrier, Mutual exclusion, Locks.

Textbook 2: Chapter 17, 18.1, 19

Module 4 - Distributed-memory parallel programming with MPI (08 hours)

Distributed memory parallel programming with MPI and message passing, Making and running MPI Program, MPI: functional parallelism, SPMD Model, starting and running MPI processes, processor identification. MPI Collectives: Reduction, Rooted collectives: broadcast, reduce. All to All, Reduce scatter, Barriers, MPI operators, non-blocking collectives, collectives and synchronization

Textbook 2: Chapter 1.1-1.3, 2.1-2.5, 3

Module 5 - Introduction to CUDA (08 hours)

Rise of GPU Computing, CUDA Architecture, Development Environment, Introduction to CUDA C, A First Program – Hello World, A Kernel Call, Passing Parameters, CUDA Parallel Programming-Summing Vectors, Applications of CUDA.

Textbook 3: Chapter 1.3-1.5, 2.2, 3.2, 4.2

PRACTICAL MODULE

PART – A

Matrix vector multiplication using OpenMP PARALLEL directive.

Sum of elements of one-dimensional real array A using OpenMP PARALLEL DO directive.

Using OpenMP, Design, develop and run a multi-threaded program to generate and print Fibonacci Series.

Largest element in a list of numbers using OpenMP CRITICAL section.

Write an OpenMP program to print Sum of Elements of Array using Reduction clause

PART – B

To calculate the sum of given numbers in parallel using MPI
Design a program that implements MPI Collective Communications
Implement Cartesian Virtual Topology in MPI
Design a MPI program that uses blocking send/receive routines.
Design a MPI program that uses non-blocking send/receive routine

PART - C
(Open Ended Problems)

CUDA is a parallel computing platform and an API model that was developed by Nvidia. Using CUDA one can utilize the power of Nvidia GPUs to perform general computing tasks, such as multiplying matrices and performing other linear algebra operations, instead of just doing graphical calculations.
To develop and execute a CUDA C/C++ program that demonstrates multiple fundamental CUDA programming concepts including kernel launching, thread indexing, vector operations, and matrix multiplication

Course Outcomes: At the end of the course the student will be able to:	
22CSE72.1	Illustrate the architecture of modern processors and vector machines.
22CSE72.2	Identify the varies types of parallel computer architectures and evaluate the corresponding performance models.
22CSE72.3	Construct shared-memory parallel programs using OpenMP
22CSE72.4	Develop distributed-memory parallel applications using MPI.
22CSE72.5	Inspect and utilize CUDA-based GPU programming techniques to implement optimized solutions for parallel computing tasks.
22CSE72.6	Design high-performance computing solutions using OpenMP, MPI and CUDA.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Introduction to High Performance Computing for Scientists and Engineers	Georg Hager, Gerhard Wellein	Chapterman & Hall / CRC Computational Science series,	2011
2	Parallel Programming in MPI and OpenMP the Art of HPC, volume 2	Victor Eijkhout	CC-BY 4.0 license.	2nd Edition, 2022
3	CUDA by Example an Introduction to General-Purpose	Jason Sanders Edward Kondrat	Addison Weasley	1st Edition, 2010
Reference Books				
1	High Performance Computing: Modern Systems and Practices	Thomas Sterling, Matthew Anderson, Maciej Borowicz	Morgan Kaufmann	2017
2	Parallel Programming in C with MPI and OpenMP	Michael J. Quinn	McGraw-Hill,	2003
3	Programming Massively Parallel Processors: A Hands-on Approach	David B. Kirk, Wen-mei W. Hwu	Morgan Kaufmann	3rd Edition, 2016

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_me61/preview **(NPTEL course on High Performance Computing for Scientists and Engineers)**
- https://www.coursera.org/learn/introduction-high-performance-computing **(Coursera course on Introduction to High-Performance and Parallel Computing)**
- https://www.coursera.org/specializations/gpu-programming **(Coursera specialization on GPU Programming (Johns Hopkins University)**
- https://omscs.gatech.edu/cse-6220-intro-high-performance-computing **(Georgia Tech OMSCS course on CSE 6220: Introduction to High-Performance Computing)**

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE72.1	3												
22CSE72.2	3	2											
22CSE72.3			2								1		
22CSE72.4			2								1		
22CSE72.5			3								1		
22CSE72.6		2	3	1				2	2				

1: Low 2: Medium 3: High

Cloud Computing			
Course Code	**22CSE73**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	Exam Hours	3 Hours
Total Hours	40 hours Theory	Credits	03

Course Learning Objectives:

- Explain the concepts, characteristics, delivery models, and benefits of cloud computing
- Explain the key technical, organizational, and challenges of cloud computing
- Understand the concepts of resource virtualization efficiently
- Analyze the security issues that arise from cloud computing architecture intended for delivery cloud-based enterprise IT services
- Illustrate the programming concept applied on cloud computing

Module-1 Introduction to Cloud Computing and Cloud ecosystem (8 hours)

Introduction: Cloud computing, an old idea whose time has come, Energy use and ecological impact of cloud computing, Ethical issues in cloud computing, Factors affecting cloud service availability, Network-centric computing and network-centric content

The cloud ecosystem: Cloud computing delivery models and services, Amazon Web Services, Google Clouds, Microsoft Windows Azure and online services.

Textbook 1: Chapter 1.1 to 1.5 and 2.1 to 2.4

Module-2 Cloud hardware and software (8 hours)

Cloud infrastructure challenges, Cloud hardware-warehouse-scale computer (WSC), WSC performance, Hypervisors, Cluster management with Borg, Containers; Docker containers, Kubernetes

Text Book 1: Chapter 4.1 to 4.4, 4.7, 4.13 to 4.14

Module-3 Cloud Resource Virtualization (8 hours)

Resource virtualization, Performance and security isolation in computer clouds, Virtual machines, Full virtualization and para-virtualization, Hardware support for virtualization, QEMU(Quick Emulator), Kernel-based Virtual Machine

Textbook 1: Chapter 5.1 to 5.7

Module-4 Applications of Cloud (8 hours)

Cloud applications: Workflow patterns, Coordination based on a state machine model—zookeeper, MapReduce programming model, Hadoop, Yarn, and Tez, SQL on Hadoop: Pig, Hive, and Impala

Textbook 1: Chapter 11.3, 11.4, 11.5, 11.7 and 11.8

Module-5 Cloud Security, Programming and Software Environments (8 hours)

Cloud security: Security, Cloud security risks, Security as a service (SecaaS), Privacy and privacy impact assessment

Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.

Textbook 1: Chapter 8.1 to 8.4, Textbook 2: Chapter 6: 6.3 to 6.5

Course Outcomes: At the end of the course the student will be able to:	
22CSE73.1	Explain the concept of Introduction to cloud services and delivery models
22CSE73.2	Illustrates the resources of cloud hardware and software models
22CSE73.3	Analyze the concept of Virtualization and how its implementation in cloud computing
22CSE73.4	Explain various applications of cloud computing
22CSE73.5	Analyze the role of security aspects in cloud computing

22CSE73.6	Explain features of programming and software of cloud computing			
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Cloud Computing: Theory and Practice	Dan C Marinescu	Elsevier	3rd Edition, 2022
2	Distributed and Cloud Computing	Kai Hwang, Geoffrey C Fox, and Jack J Dongarra,	Elsevier	1st Edition, 2012
Reference Books				
1	Mastering Cloud. Computing	Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi	McGraw Hill Education	1st Edition, 2013
2	Computing Principles and Paradigms	RajkumarBuyya , James Broberg, Andrzej Goscinsk	Willey	1st Edition, 2013

Web links and Video Lectures (e-Resources):

- https://freevideolectures.com/course/4639/nptel-cloud-computing/1.
- https://www.tutorialspoint.com/cloud_computing/index.htm
- https://www.geeksforgeeks.org/virtualization-cloud-computing-types/
- https://www.coursera.org/learn/introduction-to-cloud

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE73.1		2				2							
22CSE73.2	2	1			3	2							
22CSE73.3		2			3	2							
22CSE73.4	2	2				2							
22CSE73.5	2	2				2							
22CSE73.6						2		2					2

1: Low 2: Medium 3: High

Natural Language Processing			
Course Code	**22CSE741**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	Exam Hours	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- To understand the origin, challenges in NLP and apply various word level analysis.
- To analyse the semantic and syntactic information in the natural language text.
- To discuss and evaluate the various language applications.
- To explore various resources available for natural language processing.

Module-1 Overview and word level analysis (8 hours)

Overview: Origins and challenges of NLP Language, Grammar-Processing Indian Languages, NLP Applications

Word Level Analysis: Introduction, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging

Textbook 1: Chapter 1.1-1.7, Chapter 3.1-3.7

Module-2 Syntactic analysis and Semantic Analysis (8 hours)

Syntactic analysis: Introduction, Constituency Parsing, Parsing, Probabilistic Parsing.

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation

Textbook 1: Chapter 4.1-4.5, Chapter 5.1-5.5

Module-3 Natural Language Generation and Machine Translation (8 hours)

Natural Language Generation: Introduction, Architecture of NLG Systems Generation Tasks and Representations, Applications of NLG.

Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Direct translation, Rule-based translation, Corpus-based translation, Semantic/knowledge-based translation.

Textbook 1: Chapter 7.1-7.4, Chapter 8.1-8.8

Module-4 Information Retrieval and Lexical Resource (8 hours)

Information Retrieval: Design features of Information Retrieval Models-Classical, Non classical, Alternative Models of Information Retrieval, Evaluation of the Information Retrieval System.

Lexical Resources: Introduction, WordNet, Stemmers, POS Tagger.

Textbook 1: Chapter 9.1-9.7, Chapter 12.1-12.5

Module-5 Vector semantics and NLP using Python (8 hours)

Vector Semantics: Lexical Semantics, vector Semantics, words and vector, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector - Pointwise Mutual Information (PMI) -Neural Language Models - Word Embeddings: Word2Vec

NLP Using Python: Language Processing and Python, Accessing Text Corpora and Lexical Resources, Processing Raw Text, Writing Structured Programs, Categorizing and Tagging Words, Learning to Classify Text, Extracting Information from Text.

Textbook 3: Chapter 6.1-6.8

Textbook 2: Chapter 1,2,3,4,5,6,7

Course Outcomes: At the end of the course the student will be able to :	
22CSE741.1	Understand the origins, challenges of NLP and apply the knowledge of morphological parsing techniques.
22CSE741.2	Apply the various concepts of constituency parsing, probability parsing in syntactic

	analysis and also various approaches in semantic.
22CSE741.3	Understand the architecture of the natural language generation (NLG) system and apply the knowledge of different approaches in Machine translation
22CSE741.4	Understand the Information retrieval and Lexical resources in Natural language processing (NLP).
22CSE741.5	Understand and apply vector semantics such as TF-IDF, Cosine similarity, Pointwise Mutual Information (PMI), and neural language models.
22CSE741.6	Develop language processing, accessing a text corpus, processing a raw text, tagging of words and extraction of information from text using python programming

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U.S. Tiwary	Oxford University Press	1st Edition, 2008
2	Natural Language Processing with Python	Steven Bird, Ewan Klein, and Edward Loper	United States, O'Reilly Media	1st Edition, 2009
3	Speech and Language Processing,	Dan Jurafsky, James H. Martin	Prentice Hall	3rd Edition, 2022
Reference Books				
1	Natural Language Understanding	James Allen	Bejamin/cummings Publishing Co.	2nd Edition, 1995

Web links and Video Lectures (e-Resources):

- **Lexical Semantics:** https://nptel.ac.in/courses/106/105/106105158/
- **Machine Translation approaches:** https://builtin.com/artificial-intelligence/machine-translation

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE741.1	2												
22CSE741.2	2	2	3										
22CSE741.3	2	2	3										
22CSE741.4	2	3	3								3		
22CSE741.5	2	2	2										
22CSE741.6	2	3	3		3						3		

1: Low 2: Medium 3: High

DEEP LEARNING			
Course Code	**22CSE742**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	Exam Hours	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Learn the deep learning algorithms, which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Analyze performance metrics of deep learning techniques.

Module-1 Introduction to Neural Networks (8 hours)

Introduction to Neural Networks (NN): Introduction, The Basic Architecture of NN, Multilayer NN, Training a NN with Backpropagation, Practical Issues in NN Training, Common Neural Architectures, Notable Benchmarks,

Shallow NN: Neural Architectures for Binary Classification, Multiclass Models, Matrix Factorization with Autoencoders, Word2vec: An Application of Simple Neural Architectures

Textbook 1: Chapter 1.1-1.4, 1.6, 1.8, Chapter 2.1, 2.2, 2.3.1, 2.5.1-2.5.4, 2.6.1-2.6.2.

Module-2 Deep Neural Networks (8 hours)

Training Deep Neural Networks: Introduction, Setup and Initialization Issues, The Vanishing and Exploding Gradient Problems, Gradient-Descent Strategies, Practical Tricks for Acceleration and Compression.

Teaching Deep Learners to Generalize: Introduction, The Bias-Variance Trade-Off, Generalization Issues in Model Tuning and Evaluation

Textbook 1: Chapter 3.1, 3.3, 3.4, 3.5.1-3.5.3, 3.7, Chapter 4.1-4.3, 4.5, 4.6

Module-3 Convolutional Neural Networks (8 hours)

Convolutional Neural Networks (CNN): Introduction, The Basic Structure of CNN, Training CNN, Case Studies of Convolutional Architectures, Visualization and Unsupervised Learning, Applications of CNN

Textbook 1: Chapter 8.1-8.6

Module-4 Recurrent Neural Networks (8 hours)

Recurrent Neural Networks (RNN): Introduction, The Architecture of RNN, The Challenges of Training RNN, Long Short-Term Memory (LSTM), Gated Recurrent Units, Applications of RNN

Textbook 1: Chapter 7.1-7.3, 7.5-7.7

Module-5 Advanced Topics in Deep Learning (8 hours)

Advanced Topics in DL: Introduction, Attention Mechanisms, Neural Networks with External Memory, Generative Adversarial Networks, Competitive Learning Limitations of Neural Networks

Textbook 1: Chapter 10.1-10.6

Course Outcomes: At the end of the course the student will be able to:	
22CSE742.1	Inspect the different architectures of neural networks
22CSE742.2	Experiment with different parameters for training and generalizing deep neural networks
22CSE742.3	Design a convolutional neural network based solution
22CSE742.4	Construct recurrent neural network for sequence data.
22CSE742.5	Discover advanced methods of deep learning to address complex problems.

22CSE742.6	Appraise the practical approach using a deep neural network to solve real-world problems

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Neural Networks and Deep Learning	Charu C. Aggarwal	Springer	1st Edition, 2018
Reference Books				
1	Neural Networks and Learning Machines	Simon Haykin	PHI	3rd Edition, 2008
2	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	1st Edition, 2016

Web links and Video Lectures (e-Resources):

- **Neural Networks And Deep Learning: Charu C. Aggarwal, Textbook web page:** http://www.charuaggarwal.net/neural.htm
- **Deep Learning, An MIT Press, Textbook Web page,** https://www.deeplearningbook.org/
- **Andrew Ng's Notes on Machine Learning,** https://cs229.stanford.edu/main_notes.pdf
- **NPTEL course on Deep Learning by P K Biswas,** https://nptel.ac.in/courses/106105215
- **NPTEL course on Deep Learning - IIT Ropar,** https://onlinecourses.nptel.ac.in/noc23_cs24/preview
- **Online textbook - Neural Networks and Deep Learning by Michael Nielsen** http://neuralnetworksanddeeplearning.com/
- **Deep Learning Course by CILVR lab @ NYU** https://cilvr.cs.nyu.edu/doku.php?id=deeplearning:slides:start

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE742.1	3	3										3	
22CSE742.2	3	3	2	3									
22CSE742.3	3	2	3									3	
22CSE742.4		3	3										
22CSE742.5		3	3									3	
22CSE742.6			3	3								3	

1: Low 2: Medium 3: High

Business Analytics			
Course Code	**22CSE743**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	Exam Hours	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Understand the nature of data, statistical Modelling and visualization.
- Learn concepts of Business Intelligence and Data Warehousing.
- Gain knowledge on Data mining process , Web analytics and analytics tools.

Module-1 An Overview of Business Intelligence, Analytics, Data Science, and AI (8 hours)

An Overview of Business Intelligence, Analytics, Data Science, and AI: Changing Business Environments and Evolving Needs for Decision Support and Analytics, Decision-Making Processes and Computerized Decision Support Framework, A Framework for Business Intelligence, Analytics Overview.

Artificial Intelligence: Introduction to Artificial Intelligence, Major AI Technologies and Some Derivatives, AI Support for Decision Making, AI Applications in Various Business Functions, Conversational AI—Chatbots. **Textbook 1: Chapter 1.2-1.3, 1.5-1.6 and 2.2, 2.4-2.6, 2.9**

Module-2 Descriptive Analytics I (8 hours)

Descriptive Analytics I -Nature of Data, Big Data, and Statistical Modelling: The Nature of Data in Analytics, A Simple Taxonomy of Data, The Art and Science of Data Preprocessing, Definition of Big Data, Fundamentals of Big Data Analytics, Big Data Technologies, Big Data and Stream Analytics, Statistical Modelling for Business Analytics, Regression modelling for Inferential Statistics. **Textbook 1: Chapter 3.2-3.10**

Module-3 Descriptive Analytics II and Predictive Analytics I (8 hours)

Descriptive Analytics II: Business Intelligence Data Warehousing, and Visualization: Business Intelligence and Data Warehousing, Business Reporting, Data Visualization, Different Types of Charts and Graphs.

Predictive Analytics I - Data mining process, methods, and Algorithms: Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process.

Textbook 1: Chapter 4.2, 4.7 -4.9 and Chapter 5.2-5.4

Module-4 Predictive Analytics II and Business Analytics tools (8 hours)

Predictive Analytics II-Web, and Social Media Analytics: Web Mining Overview, Search engines, Web usage mining, social analytics

Prescriptive Analytics - Optimization and Simulation: Model-Based Decision-Making, Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk.

Business Analytics tool: KNIME- Gathering, cleaning textual data, pre-processing textual data, performing textual analysis, reporting obtained results, predicting survival using titanic dataset.

Textbook 1: Chapter 6.7 – 6.10, Chapter 8.2-8.4, Chapter 9.4

Module-5 Trends in Analytics and Data Science (8 hours)

Location-based analytics: Geospatial Analytics, Case Studies, Real-Time Location Intelligence, Analytics Applications for Consumers

IOT essentials: Definitions and characteristics, The IOT ecosystem, structure of IOT systems, Major benefits of IOT, drivers of IOT, how IOT works, IOT and decision support, sensors and their role in IOT, brief introduction to sensor technology, how sensors work with IOT.

IOT applications: smart homes and appliances, typical components of smart homes, smart appliances, smart home is where the Bot is, barriers to smart home adoption, smart components in smart cities and smart factories, improving transportation in smart cities, autonomous vehicles, implementation issues in autonomous vehicles. The future of IOT.

Textbook 1: Chapter 10.3, 10.5, 10.6

Course Outcomes: At the end of the course the student will be able to:	
22CSE743.1	Identify the role of business intelligence and analytics in a dynamic business environment.
22CSE743.2	Gain knowledge of Big Data and Statistical Modelling concepts.
22CSE743.3	Outline descriptive analytics for Business Intelligence, Data Warehousing and visualisation.
22CSE743.4	Analyse concepts of Web Mining, Models for Decision Support and analytical tools.
22CSE743.5	Interpret Location based analytics, IOT essential and applications.
22CSE743.6	Implement concepts of Business Intelligence using modern BA tools.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Intelligence, Analytics, Data Science and AI – A Managerial Perspective	Ramesh Sharda, Dursun Delen and Efraim Turban	Global Edition, Pearson Education Limited	5th Edition, 2024
Reference Books				
1	Business Intelligence Strategy and Big Data Analytics - A General Management Perspective	Steve Williams	Morgan Kaufmann (Elsevier	1st Edition, 2016
2	Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications	Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal	CRC Press	1st Edition, 2023

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc24_cs65/preview**
- **https://www.celonis.com/platform/process-mining/**

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE743.1	3												3
22CSE743.2		3		2									
22CSE743.3		3			3								
22CSE743.4				3	3								
22CSE743.5						3							3
22CSE743.6				2	2						1		

1: Low 2: Medium 3: High

UNIX System Programming			
Course Code	**22CSE744**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	Exam Hours	3 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- To understand and reason out the working of Unix Systems
- To Apply file manipulation system calls for different types of files.
- To Analyze process control primitives for different applications in multiuser environment
- To build an application/service over a Unix system

Module-1 Introduction (8 hours)

Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

Textbook 1: Chapter 1 and 5.

Module-2 UNIX Files and APIs (8 hours)

UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking.

Textbook 1: Chapter 6 and 7.

Module-3 UNIX Processes and Process Control (8 hours)

UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, Race Conditions, exec Functions

Textbook 2: Chapter 7 and 8

Module-4 Signals and Daemon Processes (8 hours)

Signals and Daemon Processes: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

Textbook 1: Chapter 9, Textbook 2: Chapter 13.

Module-5 Interprocess Communication (8 hours)

Interprocess Communication: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties.

Textbook 2: Chapter 15.

Course Outcomes: At the end of the course the student will be able :	
22CSE744.1	Understand API characteristics using POSIX standard and Use runtime & compile time limits in UNIX platform
22CSE744.2	Apply file manipulation system calls for different types of files.
22CSE744.3	Analyse process control primitives for different applications in multiuser environment
22CSE744.4	Understand daemon characteristics for coding rules

22CSE744.5	Distinguish message queues semaphores & shared memory across machine boundaries.
22CSE744.6	Discover communication between client - server using pipes and sockets.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Unix System Programming Using C++	Terrence Chan	PHI	1st Edition, 2015
2	Advanced Programming in the UNIX Environment	W.Richard Stevens, Stephen A. Rago	Pearson Education	3rd Edition, 2013
Reference Books				
1	Advanced Unix Programming	Marc J. Rochkind	Pearson Education	2nd Edition, 2005
2	UNIX System Programming: Communication, Concurrency and Threads:	Kay Robbins , Steve Robbins	Pearson Education	2nd Edition, 2015

Web links and Video Lectures (e-Resources):

- **https://www.coursera.org/learn/codio-unix-system-basics**
- **https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0132917129768058882218_shared/overview**
- **https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_013841723043299328200 9_shared?collectionType=Course&collectionId=lex_auth_01384172249519718421 86_shared&pathId=lex_auth_013841721538134016218 5_shared**

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22CSE744.1	2	2	2								1		
22CSE744.2	2	2	2								1		
22CSE744.3	2	2	1								1		
22CSE744.4	2	2									1		
22CSE744.5	2	2									1		
22CSE744.6	2	2	2								2		

1: Low 2: Medium 3: High

Major Project Phase II			
Course Code	**22CSE75**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:6)	SEE	3 Hrs
Total Hours	72 hours	Credits	06

Course Learning Objectives:

1. Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain.
2. Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints.
3. Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework.
4. Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives.
5. Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards.
6. Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.

1. Project Execution

- **Regular Meetings**: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps.
- **Documentation**: Maintain detailed documentation throughout the project in a project work-dairy, including design decisions, experiments, and testing results.
- **Milestones**: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.

2. Mid-term Review

- **Progress Presentation**: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members.
- **Feedback**: Provide constructive feedback and guidance to help students refine their projects.

3. Final Submission

- **Report**: The project report should include an abstract, introduction, literature review, methodology, implementation, results, discussion, conclusion, and references.
- **Code and Data**: If applicable, students should submit their code, datasets, and any other relevant materials.

4. Project Presentations

- **Oral Presentation**: Students should present their projects to a panel, explaining their work, findings, and contributions.
- **Demonstration**: If possible, include a live demonstration of the project or show relevant simulations and results.
- **Q&A**: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.

5. Evaluation Criteria

- **Originality and Innovation**: Assess the novelty and creativity of the project.
- **Technical Competence**: Evaluate the depth of technical knowledge and problem-solving ability demonstrated.
- **Project Execution**: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation.
- **Presentation and Communication**: Judge the clarity and coherence of the final report,

presentation, and the ability to answer questions.
6. Plagiarism Check
• **Academic Integrity**: Ensure that the work submitted is original and properly cites all references and sources. • **Plagiarism Check**: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).
7. **Mentorship and Feedback**
• **Feedback:** Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback. • **Weekly Meetings:** At least one mentorship meeting every week shall be held and recorded in the project work-dairy.
8. Post Submission
• **Publication**: DPEC shall encourage students to publish their work in conferences or journals, especially if it contributes significantly to their field. • **Project Archive**: Store all projects in the department's digital archive for future reference.

Continuous Internal Evaluation (CIE)		
Description	**Proposed Dates**	**CIE Weightage (Max 100 marks)**
1. Project Progress Evaluation -I	Beginning of the 7th Semester	20 marks
2. Project Progress Evaluation -II	Middle of the 7th Semester	30 marks
3. Project Report Evaluation (Phase II)	End of the 7th Semester	50 marks
Semester End Examinations (SEE)		
4. SEE will be conducted for 100 marks (after the last working day of the 7th semester) in the presence of the external examiner with the weightage as **Project Report: 50 marks, Project Presentation: 25 marks and Question & Answer Session: 25 marks**. Marks awarded for Project Report is same for all batch-mates.		

Course Outcomes: At the end of the course the student will be able to :	
22CSE75.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
22CSE75.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
22CSE75.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
22CSE75.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
22CSE75.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
22CSE75.6	Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE75.1	2	3			1									
22CSE75.2			3			2	1							
22CSE75.3	1	2		3										
22CSE75.4						1			3	2	2			
22CSE75.5			1				2	3						
22CSE75.6										3	2	1		

1: Low 2: Medium 3: High

VIII Semester

Professional Elective – IV (Online Course)			
Course Code	**22CSE81**	CIE Marks	50 *
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50 *
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hrs
Total Hours	36 hours	Credits	03

Course Learning Objectives:

1. Understand and apply foundational concepts and principles of the chosen elective domain to real-world engineering problems.
2. Develop the ability to learn independently and navigate MOOC platforms effectively to acquire domain-specific knowledge and skills.
3. Demonstrate analytical and problem-solving abilities by engaging in course assessments, simulations, case studies, or project-based activities.
4. Interpret and evaluate course content critically from multiple sources including video lectures, reading materials, and peer discussions.
5. Integrate interdisciplinary knowledge gained from the MOOC into core engineering subjects for innovative applications or design thinking.
6. Communicate technical ideas and solutions effectively, both in written and oral form, based on the knowledge acquired through the online course.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates.

1. Selection of MOOCs

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester/academic session.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study , a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. Approval Process

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already

claimed the benefit of completing the MOOCs under any assessment in any of the subject. **2.3 Evaluation:** The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students.
3. Registration and Enrollment
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. Course Completion
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. Assessment and Evaluation
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. Credit Transfer
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. Integration into Academic Record
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. Support and Resources
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. Feedback and Improvement
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.

Course Outcomes: At the end of the course the student will be able to :	
22CSE81.1	Demonstrate comprehensive understanding of the key concepts, tools, and techniques in the chosen elective domain.
22CSE81.2	Apply the acquired knowledge to solve domain-specific engineering problems using appropriate methods and tools.
22CSE81.3	Analyze and interpret information from MOOC resources to support decision-

	making and problem-solving.
22CSE81.4	Exhibit self-directed learning skills and effective time management to complete the MOOC as per defined timelines.
22CSE81.5	Collaborate and communicate effectively in online learning environments through discussions, peer reviews, and group tasks (if applicable).
22CSE81.6	Integrate the knowledge gained from the MOOC into interdisciplinary engineering contexts and reflect on its professional relevance.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE81.1	3	2			1									
22CSE81.2	3		2									2		
22CSE81.3					3							2		
22CSE81.4	3				2							1		
22CSE81.5									2	3		1		
22CSE81.6	3					2						1		

1: Low 2: Medium 3: High

Open Elective – II (Online Course)			
Course Code	**22CSE82**	CIE Marks	50*
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50*
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hrs
Total Hours	36 hours	Credits	03

Course Learning Objectives:

1. Gain foundational and interdisciplinary knowledge in a subject outside the core engineering specialization to promote broader intellectual development.
2. Understand key theories, models, and practices related to the open elective topic, as delivered through MOOC lectures, readings, and assessments.
3. Develop the ability to learn independently and manage learning schedules, leveraging the flexibility of the MOOC platform.
4. Apply the acquired knowledge to real-world contexts, demonstrating the relevance of interdisciplinary learning to personal, professional, or societal challenges.
5. Enhance digital learning competencies, including navigating online resources, participating in online discussions, and completing online assessments effectively.
6. Foster critical thinking, creativity, and lifelong learning mindset by exploring new domains and expanding personal and professional interests.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates.

1. Selection of MOOCs

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study , a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. Approval Process

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed the benefit of completing the MOOCs under any assessment in any of the subject.

2.3 Evaluation: The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students.
3. Registration and Enrollment
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. Course Completion
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. Assessment and Evaluation
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. Credit Transfer
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. Integration into Academic Record
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. Support and Resources
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. Feedback and Improvement
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.

Course Outcomes: At the end of the course the student will be able to :	
22CSE82.1	Demonstrate a clear understanding of the fundamental concepts and frameworks in the selected open elective domain.
22CSE82.2	Apply interdisciplinary knowledge gained from the MOOC to analyze and address real-life or cross-domain problems.
22CSE82.3	Exhibit the ability to learn independently, manage time effectively, and complete the online course requirements within the stipulated duration.

22CSE82.4	Interpret and evaluate information from diverse MOOC resources (videos, readings, forums) to support critical analysis and decision-making.
22CSE82.5	Communicate insights, reflections, and applications of the course content effectively in written or multimedia formats.
22CSE82.6	Integrate the learning from the MOOC to enhance personal, academic, or professional development beyond the engineering curriculum.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE82.1	3				1							2		
22CSE82.2	3	2										1		
22CSE82.3					3							2		
22CSE82.4	3				2							1		
22CSE82.5									2	3		1		
22CSE82.6	3					2						1		

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22CSE83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Research Internship

Course Learning Objectives:

1. To equip students with the knowledge of fundamental research principles, methodologies, and techniques applicable to their engineering discipline.
2. To enable students to formulate research questions, design experiments or studies, and use appropriate data collection and analysis tools.
3. To foster the ability to think critically and innovatively while solving complex engineering problems during the research process.
4. To guide students in developing the skills necessary for writing clear and well-structured research reports, papers, and presentations.
5. To instill an understanding of ethical practices in research, including integrity, responsible data handling, and respect for intellectual property.
6. To prepare students to work effectively in research teams, communicate their ideas clearly, and present their findings to both technical and non-technical audiences.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) and the Research Supervisor to understand the research goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, research agreements and confidentiality agreements, if applicable.
3. **Research Proposal:** Develop a research proposal in consultation with the Research Supervisor and academic mentor outlining the objectives, methodology, and expected outcomes.

During the Internship

1. **Work Plan:** Follow a structured research plan provided by the supervising researcher or mentor.
2. **Literature Review:** Conduct a comprehensive literature review to understand the current state of research in the chosen area.
3. **Regular Meetings:** Participate in regular meetings with academic and research mentors to discuss progress, challenges, and next steps.
4. **Lab Work/Field Work:** Engage in experimental work, simulations, or field studies as required by the research project.
5. **Data Collection and Analysis:** Collect, analyze, and interpret data using appropriate tools and techniques.
6. **Documentation:** Maintain detailed records of research activities, experiments, and findings.

Deliverables

1. **Weekly Reports:** Submit weekly progress reports to academic and research mentors.
2. **Monthly Reports:** Submit monthly progress reports to academic and research mentors.
3. **Mid-Term Review:** Participate in a mid-term review meeting to assess progress and realign research goals if necessary.
4. **Report and Research Paper:** Prepare a draft report and a research paper detailing the research problem, methodology, results and discussions, and conclusions.
5. **Presentation:** Deliver a presentation summarizing the research work to faculty, peers, and other stakeholders upon completion of the internship.

Assessment Criteria
1. **Research Quality:** Evaluate the quality and rigor of the research conducted. 2. **Report Quality:** Assess the clarity, organization, and thoroughness of the report and the research paper. 3. **Presentation:** Evaluate the effectiveness and clarity of the final presentation. 4. **Innovation and Creativity:** Consider the originality and innovative aspects of the research. 5. **Self-Reflection:** Review the student's ability to critically reflect on their research experience and identify areas for future growth.
Post-Internship
1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the research experience and areas of improvement. 2. **Publication:** Explore opportunities to publish the research findings in academic journals or conferences. 3. **Networking:** Maintain professional relationships established during the internship for future research collaborations.
Additional Tips
• **Curiosity:** Cultivate a curious mindset and a willingness to explore new ideas. • **Collaboration:** Work collaboratively with other researchers and team members. • **Adaptability:** Be open to modifying research approaches based on findings and feedback. • **Communication:** Develop strong written and oral communication skills to effectively present research findings. • **Time Management:** Prioritize tasks and manage time efficiently to meet research deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (Only OFFLINE)	Will be conducted during the 7th semester BE. Students shall submit the Research Internship Proposal and make a presentation and answer questions raised by the Departmental Internship Evaluation Committee (DIEC). Marks split-up: Research Internship Proposal – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): II (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on progress done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): III (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final internship report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
CIE Marks (Max 100)	Average of the CIE:I , CIE-II and CIE:III marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22CSE83.1	Apply appropriate research methodologies and tools to design and conduct experiments, analyze data, and draw conclusions.
22CSE83.2	Demonstrate the ability to identify and solve complex engineering problems through innovative and systematic research approaches.
22CSE83.3	Acquire proficiency in using advanced technologies, tools, and techniques relevant to their field of research.
22CSE83.4	Develop skills in writing comprehensive research reports, documentation, and effectively presenting research findings.
22CSE83.5	Understand and apply ethical standards in research, including plagiarism avoidance, proper citations, and data integrity.
22CSE83.6	Gain experience in working collaboratively within a research team and contributing effectively to the shared goals of the project.

References

1. **AICTE Internship Policy : Guidelines and Procedures 2019.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
2. **UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
3. **VTU Mandatory Internship Guidelines 2021.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE83.1	1		2	3										
22CSE83.2	3	2												
22CSE83.3					3	2						1		
22CSE83.4										3		1		
22CSE83.5						2		3				1		
22CSE83.6									3	2	1			

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22CSE83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Industry Internship

Course Learning Objectives:

1. To develop practical engineering skills through hands-on experience in a real-world industrial environment.
2. To enhance the ability to identify, analyze, and solve complex engineering problems encountered during the internship.
3. To gain an understanding of the functioning of the industry, including exposure to its standards, practices, and emerging technologies.
4. To improve communication, collaboration, and teamwork skills by working with professionals in a multidisciplinary team setting.
5. To foster adaptability by learning to work in dynamic and fast-paced industrial environments while embracing lifelong learning.
6. To instill a sense of professional ethics, responsibility, and accountability in engineering practice by adhering to industry-specific codes of conduct.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) to understand the internship goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, internship agreements if applicable etc.
3. **Goal Setting:** Define specific, measurable, achievable, relevant, and time-bound (SMART) goals in consultation with academic and industry mentors.

During the Internship

1. **Work Plan:** Follow a structured work plan provided by the host organization.
2. **Mentorship:** Regularly meet with assigned industry and academic mentors to review progress and seek guidance.
3. **Work Diary/Daily Report/Learning Diary:** Maintain a diary/logbook documenting daily activities, learnings, challenges, and reflections.
4. **Professional Conduct:** Adhere to the professional and ethical standards of the host organization, including dress code, punctuality, and communication protocols.
5. **Skill Application:** Actively participate in projects and tasks assigned, applying theoretical knowledge to practical situations.

Deliverables

1. **Weekly Reports:** Submit the weekly progress reports to academic and industry mentors.
2. **Monthly Reports:** Submit the monthly progress reports to academic and industry mentors.
3. **Mid-Term Review/Evaluation:** Participate in a mid-term review meeting/evaluation to assess progress and realign goals if necessary.
4. **Final Report:** Prepare a comprehensive final report in the specified format detailing the projects undertaken, skills acquired, challenges faced, and overall learning experience.
5. **Presentation:** Deliver a presentation summarizing the internship experience to faculty evaluators and peers upon completion of the internship.

Assessment Criteria
1. **Performance Evaluation:** Receive feedback from the industry mentor based on work performance, technical skills, and professional behaviour. 2. **Report Quality:** Evaluate the quality, clarity, and comprehensiveness of the final report. 3. **Presentation:** Assess the effectiveness and clarity of the final presentation. 4. **Self-Reflection:** Review the student's ability to critically reflect on their learning experience and identify areas for future growth.
Post-Internship
1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the internship experience and areas of improvement. 2. **Certification:** Obtain an internship completion certificate from the host organization. 3. **Networking:** Maintain professional relationships established during the internship for future opportunities.
Additional Tips
• **Professionalism:** Demonstrate a professional attitude and work ethic at all times. • **Adaptability:** Be open to learning and adapting to new environments and technologies. • **Communication:** Develop strong communication skills to effectively collaborate with colleagues and mentors. • **Time Management:** Prioritize tasks and manage time efficiently to meet deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on work done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
Continuous Internal Evaluation (CIE): II (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
CIE Marks **(Max 100)**	Average of the CIE:I and CIE:II marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22CSE83.1	Apply engineering concepts and theoretical knowledge to solve real-world industry problems.
22CSE83.2	Enhance their problem-solving abilities by identifying, analyzing, and providing innovative solutions to engineering challenges in the industry.
22CSE83.3	Develop key professional skills such as teamwork, communication, and time management in a corporate or industrial environment.
22CSE83.4	Gain exposure to industry-standard tools, technologies, methodologies, and regulatory standards relevant to their field of study.
22CSE83.5	Demonstrate understanding and adherence to professional ethics, safety regulations, and responsibilities in an industrial setting.
22CSE83.6	Build a network of industry professionals and gain insights into career opportunities, preparing them for future employment in the engineering sector.

References

1. **AICTE Internship Policy: Guidelines and Procedures 2019.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
2. **UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
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Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE83.1	3	2				1					1			
22CSE83.2		3	2	1							1			
22CSE83.3									3	2				
22CSE83.4					3	2						1		
22CSE83.5						2		3						
22CSE83.6									2	3		1		

1: Low 2: Medium 3: High

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MOTTO

Service & Excellence

VISION

To be a global premier Institution of professional education and research.

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.
- Attract, nurture and retain the best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities (ESR) of the institution.

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