Fourth Year BE

SCHEME & SYLLABUS

Autonomous Scheme 2021-22

Computer Science and Engineering

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

MOTTO

Service and 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

ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE, ECE, EEE, ME and CIV) & PG (MBA and MCA)
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2021-22)

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). Five of the UG programs, namely Computer Science & Engineering, 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:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. 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.
4. Conduct investigations on 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.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: 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.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. 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.
11. 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.
12. 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)

Graduates of the Computer Science and Engineering program are able to

PSO 1. Understand the principles underlying entrepreneurship, freelancing and the requirements to initiate a start-up in the IT or related domains.

PSO 2. Participate effectively in competitive examinations for career growth, higher studies and to pursue research.

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	PCC	21CSE701	Cloud Computing	CSE	CSE	3	-	-	03	50	50	100	3
2	PCC	21CSE702	Software Testing	CSE	CSE	3	-	-	03	50	50	100	3
2	PEC	21CSE703X	Professional Elective - 2	CSE	CSE	3	-	-	03	50	50	100	3
3	PEC	21CSE704X	Professional Elective - 3	CSE	CSE	3	-	-	03	50	50	100	3
4	OEC	21CSE705X	Open Elective - 2	CSE	CSE	3	-	-	03	50	50	100	3
5	SDC	21CSS706	Technical Seminar	CSE	CSE	-	-	2	-	100	--	100	1
6	SDC	21CSP707	Major Project Work (Phase I & II)	CSE	CSE	-	-	6	03	50	50	100	5
					Total	**15**	**-**	**8**	**18**	**400**	**300**	**700**	**21**

21CSE703X Professional Elective -2 Course			
21CSE7031	Go Programming	21CSE7032	UI/UX Design
21CSE7033	Data Analysis Using R Programming	21CSE7034	Salesforce Developer

21CSE704X Professional Elective -3 Course			
21CSE7041	Computer Vision	21CSE7042	Parallel Computing
21CSE7043	Natural Language Processing		

21CSE705X Open Elective -2 Course			
21CSE7051	Introduction to Cyber Security	21CSE7052	Introduction to Data Structures
21CSE7053	Operating Systems		

VIII Semester (B.E. – Computer Science and Engineering)														
Sl. 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**	
						L	**T**	**P**					
1	SDC	21AEC801	MOOC	Any MOOC topic (Choices are given by respective Department) with minimum 8 weeks to be completed between III Sem to VIII Sem								100	2
2	SDC	21CSP802	Major Project Work (Final Presentation and Report Submission)	CSE		-	-	-	03	50	50	100	5
3	INT	21INT803	Research / Industry Internship			-	-	-	03	50	50	100	10
Total						-	-	-	**06**	**100**	**100**	**300**	**17**

Research Internship / Industry Internship is to be carried out during the 8th semester for 15 weeks.

AICTE Activity Points to be earned by students admitted to BE/B.Tech/B. Plan day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VII Semester

Cloud Computing			
Course Code	**21CSE701**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Discuss the concepts, characteristics, delivery models, and benefits of cloud computing.
- Explore the key technical, organizational, and compliance challenges of cloud computing.
- Grasp the concepts of virtualization efficiently.
- Discuss the cloud resource management and scheduling shcemes.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud-based enterprise IT services.

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. User challenges and experience

Text Book 1: Chapter 1.1 to 1.5, 2.1. to 2.4 and 2.10

Module-2 Cloud Hardware and Software (8 hours)

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

Text Book 1: Chapter 4.1 to 4.4, 4.7, 4.11 and 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, Kernel-based Virtual Machine, Nested virtualization, The darker side of virtualization

Textbook 1: 5.1 to 5.7, 5.10 and 5.15.

Module-4 Cloud Resource Management, Scheduling (8 hours)

Policies and mechanisms for resource management, Scheduling algorithms for computer clouds, Delay scheduling, Data-aware scheduling, Apache capacity scheduler, Start-time fair queuing, Borrowed virtual time.

Text Book 1: 9.1 to 9.7.

Module-5 Cloud Security and Cloud Applications (8 hours)

Cloud security: Cloud security risks, Security as a service (SecaaS), Privacy and privacy impact assessment, Trust, Cloud data encryption, Security of database services, Operating system security, Virtual machine security.

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

Textbook 1: 8.1 – 8.10, 11.4, 11.5, 11.7 and 11.8

Course Outcomes: At the end of the course the student will be able :	
21CSE701.1	To Compare the strengths, limitations of cloud computing and explain delivery models cloud eco system.
21CSE701.2	To Understand the hardware and software requirements for the cloud computing.
21CSE701.3	To understand the concept of Virtualization and how it is implemented in cloud computing.
21CSE701.4	To Understand Cloud Resource Management and Scheduling schemes.
21CSE701.5	Identify the known threats, risks, vulnerabilities, and privacy issues associated with Cloud-based IT services.
21CSE701.6	Explains various applications 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 (MK)	3rd Edition, 2022
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

Additional Resources: Web links/NPTEL Courses

- https://www.javatpoint.com/cloud-computing-tutorial
- https://www.tutorialspoint.com/cloud_computing/index.htm
- https://www.digimat.in/nptel/courses/video/106105167/L01.html

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE701.1		2				2								2
21CSE701.2	2	1			3	2								
21CSE701.3		2			3	2								
21CSE701.4	2	2				2								
21CSE701.5	2	2				2								
21CSE701.6						2		2						2

1: Low 2: Medium 3: High

SOFTWARE TESTING			
Course Code	**21CSE702**	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 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand the Software Testing objectives and the Life cycle.
- Differentiate the various testing techniques.
- Analyze the problem and derive suitable test cases.
- Apply suitable technique for designing of flow graph.
- Explain the need for planning and monitoring a process.
- To apply the automated testing tools and metrics.

Module-1 Introduction to Software Testing (8 hours)

Context of Testing, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Software Testing Terminology-Definitions: Failure, Fault/Defect/Bug, Error, Test Case, Test ware, Incident, Test Oracle, Life cycle of Bugs, State of Bugs, Software Testing Life Cycle(STLC), Testing Life Cycle Model, Quality, Quality Assurance and Quality Control

(Text Book1-1.1, 2.2)
(Text Book2-1.4,1.6,1.7,2.1.1,2.1.2,2.1.3, 2.2, 2.3.4)

Module-2 Methods of Testing (8 hours)

Software testing Terminology and Methodology: Testing Tactics, White Box Testing: What is white box testing?, Static Testing, Structural Testing: Unit/code functional testing, Code coverage Testing, Code complexity Texting, Black box Testing: What is Black box testing?, Why Black box Testing? , When to do a Black box testing?, How to do a Black box Testing?:Requirements based Testing, Positive and negative testing, Boundary value analysis, Decision tables, Equivalence partitioning, State based testing, Compatibility testing, User documentation testing, Domain testing

(Text Book1- 3.1, 3.2, 3.3.1-3.3.3, 4.1, 4.2, 4.3, 4.4.1-4.4.9)
(Text Book2-2.3.6)

Module-3 Types and levels of Testing (8 hours)

Unit Validation Testing, Integration Testing: What is Integration Testing? Integration testing as a type of Testing: Top-down Integration, Bottom-up Integration, Bi-directional Integration, System integration, Choosing integration method, System and Acceptance Testing: Why is system testing done? Categories of System Tests, Functional System Testing, Nonfunctional Testing, Acceptance testing: Alpha testing, Beta testing.

(Text Book1-5.1, 5.2.1-5.2.5, 6.2, 6.4, 6.5)
(Text Book2-7.1, 7.4.1,7.5.1,7.5.2)

Module-4 Test Planning, Management, Execution and Reporting (8 hours)

Test Planning: Preparing a test plan, Scope Management, Deciding the test approach, Setting up criteria for testing, Identifying responsibilities, Staffing, and Training Needs, Identifying Resource Requirements, Identifying Test Deliverables, Testing task, Test Management: Choice of standards, Test infrastructure management, Test people management, Test Process, Test Reporting

(Text Book1-15.2.1-15.2.8,15.3.1-15.3.3,15.4,15.5)

Module-5 Testing Tools, Metrics and Measurements (8 hours)

Automation and Testing tools: Need for automation, Categorization of Testing tools, Selection of Testing tools, Guidelines for Automated Testing, Test Metrics and Measurement: What are Metrics and Measurements? Why metrics in Testing? Types of metrics, Project metrics, Progress metrics, Productivity metrics

(Text Book1-16.5,17.1, 17.2, 17.3, 17.4, 17.5, 17.6)
(Text Book2-15.1,15.2,15.3,15.5)

Course Outcomes: At the end of the course the student will be able to:	
21CSE702.1	Derive test cases for any given problem.
21CSE702.2	Compare the different testing techniques.
21CSE702.3	Classify the problem into suitable testing model.
21CSE702.4	Apply the appropriate technique for the design of flow graph.
21CSE702.5	To prepare the Test plan and to produce the report.
21CSE702.6	Apply the appropriate Automated Testing Tools and Metrics.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Software testing: Principles and Practices	Gopalaswamy Ramesh, Srinivasan Desikan,	Pearson	1st Edition, 2007
2	Software testing: Principles and Practices	Chauhan Naresh	Oxford University Press	2nd Edition, 2016
Reference Books				
1	Foundations of Software Testing	Aditya P Mathur	Pearson Education	2nd Edition, 2013
2	Software Testing, A Craftsman's Approach	Paul C. Jorgensen	Auerbach Publications	4th Edition, 2013
3	Software Testing and Analysis – Process, Principles and Techniques	Mauro Pezze, Michal Young	Wiley India	1st Edition, 2008

Web links and Video Lectures (e-Resources):

- https://www.softwaretestinghelp.com/selenium-tutorial-1/
- http://softwaretestingfundamentals.com/software-testing-methods/
- https://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf
- https://nptel.ac.in/courses/106105150/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE702.1			2											
21CSE702.2	2													
21CSE702.3			2		2									
21CSE702.4					2									
21CSE702.5					3					3				
21CSE702.6			2											

1: Low 2: Medium 3: High

Go Programming			
Course Code	**21CSE7031**	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 Hours
Total Hours	40 hours	Credits	03

- **Course Learning Objectives:**
- To apply the basic program structures and data types of Golang
- To build functions and methods of Golang.
- To utilize linear and non-linear data structures for sorting and searching algorithms in Golang
- To discover the applications of Golang in Network programming and web services.

Module-1 Introduction to Go (8 hours)

Program Structure: Names, declarations, variables, assignments, Type declarations, Packages and Files, Scope
Basic Data types: Integers, floating point numbers, complex numbers, Booleans, strings, constants.
Composite Data types: Arrays, Slices, Maps, Structs, JSON
Textbook 1: Chapter 2, Chapter 3, Chapter 4

Module-2 Functions and Methods (8 hours)

Functions: Function declarations, recursion, multiple return values, errors, function values, anonymous functions, variadic functions, deferred function calls, panic, recover.
Methods: Method declarations, methods with a pointer receiver, composing types by struct embedding, method values and expressions, encapsulation.
Textbook 1: Chapter 5, Chapter 6

Module-3 Foundations of Network Programming with GO (8 hours)

http.Roundtripper: http.Response, http.Request, http.Transport, TCP/IP, IPv4 and IPv6, nc(1) command line utility, Reading configuration of network interfaces, performing DNS lookups: Getting the NS records of a domain, Getting the MS records of a domain
Creating a web server in GO: using the atomic package, profiling an HTTP server, creating a website in GO, HTTP tracing, creating a web client in GO, timing out HTTP connections, wireshark and tshark tools, gRPC and Go
Textbook 2: Chapter 12

Module-4 Go and Microservices (8 hours)

Introduction to microservices: Building a simple web server, reading and writing JASON, Unmarshalling JSON to GO constructs, Routing in net/http, context, RPC in Go standard library.
Designing a great API: Restful API, URIs, URI format, URI path design for REST services, HTTP verbs, URI query design, Response codes, HTTP headers, RPC API, versioning API, object type standardization, Documenting APIs
Textbook 4: Chapter 1, Chapter 2

Module-5 Database and Golang (8 hours)

In-memory storage, File storage: reading and writing CSV files, gob package
Go and SQL: Setting up database, connecting to the database, creating a post, retrieving a post, updating a post, deleting a post, getting all posts, Go and SQL relationships: setting up databases, one-to-many relationships, Go relational mappers: sqlx, Gorm
Textbook 3: Chapter 6

Course Outcomes: At the end of the course the student will be able:	
21CSE7031.1	Identify and apply the programming constructs of Golang
21CSE7031.2	Develop functions and methods in Golang
21CSE7031.3	Utilize linear, non-linear data structures for searching and sorting algorithms
21CSE7031.4	Apply Golang for computer network applications
21CSE7031.5	Build Golang programs for storing data in CSV files
21CSE7031.6	Design Golang programs for managing SQL database

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	The Go Programming language	Alan A. A. Donovan & Brian W. Kernighan	Addison-Wesley	1st Edition, 2016
2	Mastering Go	Mihalis Tsoukalos	Packt	2nd Edition, 2019
3	Go Web Programming	Sau Sheong Chang	Manning Publications	1st Edition, 2016
4	Building Microservices with Go	Nic Jackson	Packt	1st Edition, 2017
Reference Books				
1	Go in Action	William Kennedy	Manning Publications	1st Edition, 2016

Additional Resources: Web links/NPTEL Courses

TOC - TechA GO Programming Certification | Infosys Springboard (onwingspan.com) (Go Programming certificate course)

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7031.1		3	3										3	
21CSE7031.2		3	3		3								3	
21CSE7031.3		3	3		3								3	
21CSE7031.4			3	2	2							2		3
21CSE7031.5		3		2	2							2		3
21CSE7031.6		3	3	2	2							2		3

1: Low 2: Medium 3: High

UI/UX DESIGN			
Course Code	**21CSE7032**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Explore the Fundamentals of UX Design.
- Examine the Concepts of Menus, User Interfaces, and Design Processes
- Develop and Organize User-Friendly Information Architectures
- Utilize Tools and Techniques for Prototyping
- Apply Methods for Testing and Evaluating UX Designs

Module- FOUNDATIONAL ELEMENTS OF UI/UX: (8 hours)

User Experience and Why It Matters, Everyday Miseries, Introducing User Experience, From Product Design to User Experience Design, designing (for) Experience: Use Matters, User Experience, and the Web, Good User Experience Is Good Business, Minding Your Users
Meet the Elements, The Five Planes, The Surface Plane, The Skeleton Plane, The Structure Plane, The Scope Plane, The Strategy Plane, Building from Bottom to Top, A Basic Duality, The Elements of User Experience the Strategy Plane, The Scope Plane, The Structure Plane, The Skeleton Plane, The Surface Plane, Using the Elements
Textbook 1: Ch 1,2

Module-2 USER INTERFACE DESIGN PROCESS AND SYSTEM MENUS (8 hours)

The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business Functions-Business definition and requirement analysis, Basic business functions, Design standards. System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, selecting menu choices, Navigating menus, Kinds of graphical menus.
Textbook 3: Part 2

Module-3 Design Process and Information Architecture: (8 hours)

Defining Project Scope and Requirements, Functional Specification, Prioritizing requirements Content requirements, Information Architecture Basics, Interaction Design Principles, Wireframing and Layout Design.
Textbook 1: Ch 4,5

Module-4 Prototyping and Visual Design (8 hours)

The Skeleton Plane: Interface Design, Navigation Design, and Information Design.
The Surface Plane: Sensory Design: -Defining the surface, Making Sense of the senses, Contract and uniformity, Internal and External Consistency, Color Palettes and Typography
Textbook 1: Ch 6,7

Module-5 Testing and Evaluating UX Designs (8 hours)

Usability Testing on 10 Cents a Day, Usability as common courtesy, Accessibility, Cascading style sheet and you
Textbook 2: Ch 9,10,11

Course Outcomes: At the end of the course the student will be able	
21CSE7032.1	Summarize the foundational understanding of UX design
21CSE7032.2	Define the UI design process, its obstacles, and pitfalls in the development process of UI
21CSE7032.3	Identify the need for defining a good structure of menus along with their functions and contents.

21CSE7032.4	Develop knowledge and skills to effectively plan, structure, and organize digital products, ensuring user-friendly interfaces
21CSE7032.5	Experiment with various visual design aspects, visual look and feel of the user experiences
21CSE7032.6	Analyse the need of usability testing and identify various testing methods to apply on the designed User Interface

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	The Elements of User Experience: User-centered Design for the Web	Jesse James Garrett	New Riders	2nd Edition, 2010
2	Don't Make Me Think: A Common Sense Approach to Web Usability	Steve Krug	New Riders	2nd Edition, 2006
3	The Essential Guide to User Interface Design	Wilbert O. Galitz,	John Wiley & Sons	2nd Edition, 2002
Reference Books				
1	Design the User Interface	Ben Sheiderman	Pearson Education	1998
2	The Essential of User Interface Design	Alan Cooper	Wiley- Dream Tech Ltd	2002

Additional Resources: Web links/NPTEL Courses

- User Interface Design By Prof. Saptarshi Kolay IIT Roorkee: https://onlinecourses.nptel.ac.in
- https://www.andacademy.com/lp/ui-ux-design-diploma
- https://www.interaction-design.org/courses
- https://www.coursera.org/specializations/ui-ux-design

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7032.1	2												2	
21CSE7032.2						2							2	
21CSE7032.3			2			2								
21CSE7032.4			2			2								
21CSE7032.5			2							3				
21CSE7032.6			2							3				

1: Low 2: Medium 3: High

Data Analysis using R Programming			
Course Code	**21CSE7033**	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 Hours
Total Hours	40	Credits	03

Course Learning Objectives:

- Build R scripts for importing data and manage subsets of data.
- Apply R based functions to manage data tables and plot the data.
- Analyze the data using R scripts by applying statistical functions.
- Demonstrate the visualization of data using R functions.

Module-1 First Steps in R (8 hours)

Introduction: R as a calculating Environment, Basic Programming, Input and Output.
First steps in R: Typing in small datasets, Concatenating Data with the c Function, Combining Variables with the c, cbind, and rbind Functions, Combining Data with the vector Function, Combining Data Using a Matrix, Combining Data with the data. frame Function, Combining Data Using the list Function, **Importing Data:** Importing Excel Data, Accessing Data from Other Statistical Packages, Accessing a Database
Textbook 1: Chapter-2-4
Textbook 2: Chapter 2.1.1-, 2.1.7, 2.2, 2.2.1-2.2.3

Module-2 Accessing Variables and Managing Subsets of Data (8 hours)

Accessing Variables and Managing Subsets of Data: Accessing Variables from a Data Frame, Accessing Subsets of Data, Combining Two Datasets with a Common Identifier, Exporting Data, Recoding Categorical Variables
Textbook 2: Chapter 3.1- 3.5

Module-3 Functions (8 hours)

Simple Functions: The tapply Function, The sapply and lapply Functions, The summary Function, The table Function, **An Introduction to Basic Plotting Tools:** The plot Function, Symbols, Colours, and Sizes, Adding a Smoothing Line
Textbook 2: Chapter 4.1-5.3

Module-4 Statistics with R (8 hours)

Basic Mathematics: Basic mathematical functions, matrix operations, numerical integration differentiation, optimization. **Descriptive Statistics using R:** Structuring variables according to Type Data Tables, Numerical summaries
Textbook 3: Chapter 10.1- 10.5, 11.2-11.4

Module-5 Graphical Representations with R (8 hours)

Graphical Representations: Plotting qualitative variables, Plotting ordinal variables, Plotting discrete quantitative variables, Plotting continuous quantitative variables, Graphical representations in a bi-variate setting
Textbook 3: Chapter 11.6.1-11.6.5

Course Outcomes: At the end of the course the student will be able to:	
21CSE7033.1	Demonstrate data manipulation using R programming.
21CSE7033.2	Utilize R scripts to access variables and manage subsets of data.
21CSE7033.3	Inspect the data using R functions and plotting tools.
21CSE7033.4	Solve statistical problems for the given data using R.
21CSE7033.5	Develop solutions for visualizing the data using R programming.

21CSE7033.6	Apply statistical analysis and provide visual representations of the data.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Scientific Programming and Simulation using R	Owen Jones, Robert Meillarbet and Andrew Robin Son	TRC Press	2nd Edition 2014
2	A Beginner's Guide to R	Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters	Springer	1st Edition 2009
3	The R Software-Fundamentals of Programming and Statistical Analysis	Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet	Springer	1st Edition 2013
Reference Books				
1	Introduction to Statistics and Data Analysis	Christian Heumann, Michael Schomaker and Shalabh	Springer	1st Edition 2016

Web links and Video Lectures (e-Resources):

- **R project website:** https://www.r-project.org
- **Sample R projects:** https://github.com/veeralakrishna/Datacamp-Project-Solutions-R
- **Infosys Springboard:** https://infyspringboard.onwingspan.com/web/en/login

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE7033.1					3									3
21CSE7033.2				3	2									3
21CSE7033.3					3									3
21CSE7033.4				2										3
21CSE7033.5				3										3
21CSE7033.6					2					3				3

1: Low 2: Medium 3: High

Salesforce Developer			
Course Code	**21CSE7034**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- To be intended for an individual who has experience developing and deploying basic business logic and user interfaces.
- Train the individuals to the next level, who have the knowledge, skills, and experience in building custom applications on the Lightning Platform.
- To learn the fundamental programmatic capabilities of the Lightning Platform to develop custom business logic and interfaces to extend Salesforce using Apex, Visualforce, and basic Lightning Components.
- To use the programmatic capabilities in practice with the Lightning Platform, including practical application of the skills and concepts.

Module-1 Platform Developer (8 hours)

Apex & .NET Basics: Map .NET Concepts to the Lightning Platform, Understand Execution Context, Use Asynchronous Apex, Debug and Run Diagnostics

Formulas and Validations: Use Formula Fields,Implement Roll-Up Summary Fields, Create Validation Rules

Data Modeling : Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder

Data Management: Import Data, Export Data

Approve Records with Approval Processes: Customize How Records Get Approved, Build an Approval Process

Record-Triggered Flows: Triggered Flows, Build a Record-Triggered Flow, Add a Scheduled Task to Your Flow, Meet Flow Trigger Explorer

Search Solution Basics: Choose the Right Search Solution, Build Search for Common Use Cases, Optimize Search Results

Apex Basics & Database: Get Started with Apex, Use sObjects, Manipulate Records with DML, Write SOQL Queries, Write SOSL Queries

Apex Triggers : Get Started with Apex Triggers, Bulk Apex Triggers

Module-2 Triggers (8 hours)

Triggers and Order of Execution: Performing a sequence of events in a order when a record is saved with an insert, update, or upsert statement

Asynchronous Apex: Asynchronous Processing Basics, Use Future Methods, Use Batch Apex, Control Processes with Queueable Apex, Schedule Jobs Using the Apex Scheduler, Monitor Asynchronous Apex

Module-3 Introduction to Visualforce (8 hours)

Visualforce & Lightning Experience: Use Visualforce in Lightning Experience, Develop Visualforce Pages for Lightning Experience, Explore the Visualforce App Container, Share Visualforce Pages Between Classic and Lightning Experience, Manage Navigation, Understand Important Visual Design Considerations, Know Which Features to Avoid in Lightning Experience.

Visualforce Basics: Get Started with Visualforce, Create & Edit Visualforce Pages, Use Simple Variables and Formulas, Use Standard Controllers, Display Records, Fields, and Tables, Input Data Using Forms, Use Standard List Controllers, Use Static Resources, Create & Use Custom Controllers.

Module-4 Web Components (8 hours)

Lightning Web Components Basics: Discover Lightning Web Components, Create Lightning Web Components, Deploy Lightning Web Component Files, Handle Events in Lightning Web Components, Add Styles and Data to a Lightning Web Component Secure Server-Side

Development: Write Secure Apex Controllers, Mitigate SOQL Injection, Mitigate Cross-Site Request Forgery

Module-5 Testing & Debugging (8 hours)

Developer Console Basics: Get Started with the Developer Console, Navigate and Edit Source Code, Generate and Analyze Logs, Inspect Objects at Checkpoints, Execute SOQL and SOSL Queries

Command-Line Interface: Learn About the Command-Line Interface, Explore Command Structure and Navigation, Set Up Command-Line Tools.

Org Development Model: Plan for Changes to Your Org, Develop and Test Changes Locally, Test and Deploy Changes

Apex Testing: Get Started with Apex Unit Tests, Test Apex Triggers, Create Test Data for Apex Tests

Find and Fix Bugs with Apex Replay Debugger: Launch Your Trailhead Playground, Set Up Visual Studio Code, Set Up Apex Replay Debugger, Debug Your Code

Debug Logs: Debug Log Details, Debug Log Order of Precedence, Debug Log Levels, Searching a Debug Log, Delete Debug Logs, Debug Log Filtering for Apex

Course Outcomes: At the end of the course the student will be able :	
21CSE7034.1	Acquire a fundamental understanding of the CRM
21CSE7034.2	To earn experience on Salesforce tools necessary to effectively generate useful applications on the Salesforce platform to support customer requirements.
21CSE7034.3	Understand the tools and techniques of CRM
21CSE7034.4	Gain experience in using the Salesforce tools to complete projects focused on obtaining actionable insights from complex data.
21CSE7034.5	Dive deeply into a Salesforce Developer practice to fully prepare to use knowledge gained in the course to add significant value in a professional setting.
21CSE7034.6	Be able to utilize knowledge and skills to continue learning and adapting to other advanced Salesforce technologies.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Beginning Salesforce Developer	Michael Wicherski	Wiley Apress Publisher	2018
2	Learning Salesforce Development with Apex	Paul Battisson	BPB Publishers	2020
3	Advanced Apex Programming in Salesforce	Advanced Salesforce	PACKT Publisher	2018

4	Mastering Apex Programming	Paul Battisson	Paul Battisson	2020
Reference Books				
1	Learning Salesforce Lightning Application Development: Build and test Lightning Components for Salesforce Lightning Experience using Salesforce DX	Mohith Shrivastava	PACKT Publisher	2018
2	Lightning Web Components (LWC) Development on the Salesforce Platform: A Salesforce developer's guide to building, testing, and deploying Lightning Web Components	Brian Cline	PACKT Publisher	2023

Additional Resources: Web links/NPTEL Courses

- **Use the Trailhead Platform:** https://www.salesforce.com/blog/what-is-trailhead/
- **The Salesforce Developer Trailmix :** https://trailhead.salesforce.com/users/trjha3/trailmixes/salesforce-developer-catalyst-v-3-0

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7034.1		2			1							2		
21CSE7034.2					1			3		2				
21CSE7034.3						2				2				
21CSE7034.4						2				2				
21CSE7034.5						2				2				
21CSE7034.6						2				2				

1: Low 2: Medium 3: High

Computer Vision			
Course Code	**21CSE7041**	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 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand and master basic knowledge, theories and methods in image processing and computer vision.
- Analyses and examine existing practical computer vision systems.
- Design and develop practical and innovative image processing and computer vision applications or systems.

Module-1: Introduction to Computer Vision (8 Hours)

Introduction: What is Computer Vision, Applications, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.
Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels
T1: 1.1, 1.3-1.5, 2.1-2.5

Module-2: Early Vision (8 hours)

Spatial Domain: Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. **Image Features:** Computing and Representing the Image Gradient, Finding Corners and Building Neighborhoods, Describing Neighborhoods with SIFT and HOG Features, Introduction to Stereopsis
T1: 3.1-3.6, T2: 5.1-5.4, 7.1, 7.2

Module-3: Mid-Level Vision (8 hours)

Segmentation: Fundamentals, Point, Line, and Edge Detection, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds.
Tracking: Simple Tracking Strategies, Tracking Using Matching
T1: 10.1-10.4,10.6-10.7 T2: 11.1-11.2

Module-4: High-Level Vision (8 hours)

Image Registration: Registering Rigid Objects, Registering Deformable Objects, Applications
Range Data: Active Range Sensors, Range Data Segmentation, Range Image Registration and Model Acquisition, Object Recognition
Classifying Images: Building Good Image Features, Classifying Images of Single Objects
T2: 12.1, 12.3, 14.1-14.4, 16.1, 16.2

Module-5: Object Detection and Recognition (8 hours)

Detecting Objects in Images: The Sliding Window Method, Detecting Deformable Objects
Feature Extraction: Boundary Preprocessing, Boundary and Region Feature Descriptors
Recognition: Pattern Classes, Pattern Classification by Prototype Matching
T2: 17.1, 17.2, 11.1-11.4, 12.1-12.3

Course Outcomes: At the end of the course the student will be able to:	
21CSE7041.1	Understand the concepts of image formation, color models and linear filtering.
21CSE7041.2	Identify and apply mathematics behind feature extraction and description methods.

21CSE7041.3	Suggest a design for image segmentation and object tracking.
21CSE7041.4	Apply different techniques for image registration and processing range images.
21CSE7041.5	Design techniques for object detection and categorization from images.
21CSE7041.6	Formulate and solve problems in image processing and computer vision.

Sl. No.	Title of the Book	Name of the Author/s	Publisher	Edition and Year
Textbooks				
1	Digital Image Processing	Rafael C. Gonzalez, Richard E. Woods	Pearson	4th Edition, 2018
2	Computer vision- A modern approach	David A. Forsyth, Jean Ponce	Pearson	2nd Edition, 2012
Reference Books				
1	Computer Vision: Algorithms & Applications	Richard Szeliski	Springer	2nd Edition, 2022
2	Multiple View Geometry in Computer Vision	Richard Hartley, Andrew Zisserman	Cambridge Press	2nd Edition, 2004
3	Programming Computer Vision with Python	Jan Erik Solem	O'Reilly	1st Edition, 2012

Web links and Video Lectures (e-Resources):

- **NPTEL course on Computer Vision, Prof. Jayanta Mukhopadhyay, IIT Kharagpur Link**: https://onlinecourses.nptel.ac.in/noc19_cs58/preview
- **NPTEL course on Deep Learning for Computer Vision, Prof. Vineeth N Balasubramanian, IIT Hyderabad Link:** https://onlinecourses.nptel.ac.in/noc21_cs93/preview
- **Course web page - Computer Vision 1- Bastian Leibe (RWTH Aachen University) Link:** http://www.vision.rwth-aachen.de/course/11/
- **Course web page - Computer Vision 2 - Bastian Leibe (RWTH Aachen University) Link:** http://www.vision.rwth-aachen.de/course/9/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7041.1	3	2	2	3	2		1			2	1	2	2	2
21CSE7041.2	2	2		3	3	2	1			2	1		1	
21CSE7041.3		2	2	3						2	1	3	1	1
21CSE7041.4	2	2	3		3	2	1	1	1			2	1	
21CSE7041.5	2		2	2			1		1	2				1
21CSE7041.6	2			3	3			1	2	2	1	2		

1: Low 2: Medium 3: High

Parallel Computing			
Course Code	**21CSE7042**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Understand the need of parallel computing
- Understand the concepts of Parallel Computers, Data and Temporal Parallelism
- Acquire knowledge on the concepts of Operating Systems for Parallel Computers
- Familiarize concepts of Shared Memory Programming with MPI
- Use OpenMP and Parallel algorithms in real world scenario

Module-1 Introduction to Parallel Computing (8 hours)

Introduction to Parallel Computing: Need of Performance, Building Parallel Systems, why to Write Parallel Programs? How to Write Parallel Programs? Approach: Concurrent, Parallel, Distributed

Parallel Hardware and Parallel Software: Background, Modifications to the von Neumann Model, Parallel Hardware, Parallel Software, Input and Output, Performance, Parallel Program Design and Writing and Running Parallel Programs

Textbook 1: Ch. 1.1-1.4, 1.6, 2.1-2.8.

Module-2 Distributed Memory Programming with MPI (8 hours)

Distributed Memory Programming with MPI: Getting Started, The Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived Data types, A Parallel Sorting Algorithm

Textbook 1: Ch. 3.1-3.5, 3.7

Module-3 Shared Memory Programming with Pthreads (8 hours)

Shared Memory Programming with Pthreads: Processes, Threads and Pthreads, Hello World program, Matrix-Vector Multiplication, Critical Sections Busy-Waiting, Mutexes, Producer-Consumer Synchronization and Semaphores, Barriers and Condition Variables, Read-Write Locks, Caches, Cache Coherence, and False Sharing and Thread-Safety.

Textbook 1: Ch. 4.1-4.11

Module-4 Shared Memory Programming with OpenMP (8 hours)

Shared Memory Programming with OpenMP: Introduction to OpenMP, The Trapezoidal Rule, Scope of Variables, The Reduction Clause, The Parallel for Directive.

Textbook 1: Ch. 5.1-5.5

Module-5 OpenMP, Parallel Program Development and Parallel Algorithms (8 hours)

OpenMP, Parallel Program Development and Parallel Algorithms: More About Loops in OpenMP: Sorting, Scheduling Loops, Producers and Consumers, Caches, Cache-Coherence, and False Sharing and Thread-Safety, Two N-Body Solvers, Tree Search

Textbook 1: Ch. 5.6-5.9, 5.11, 6.1,6.2

Course Outcomes: At the end of the course the student will be able :	
21CSE7042.1	To develop an understanding of various basic concepts associated with parallel computing environments

21CSE7042.2	Analyse the hardware and software required for parallel computing
21CSE7042.3	To gain experience in a number of different parallel computing paradigms including memory passing, memory sharing, data-parallelism and other approaches.
21CSE7042.4	To earn experience in designing and testing parallel computing solutions to programming problems
21CSE7042.5	To understand the effects that issues of synchronization, latency and bandwidth have on the efficiency and effectiveness of parallel computing applications.
21CSE7042.6	Understand the distributive memory programming with MPI and OpenMP

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	An introduction to parallel programming	Peter S Pacheco	Morgan Kaufmann Publishers	Illustrated Edition, 2011.
Reference Books				
1	Parallel Programming in C with MPI and OpenMP	M.J. Quinn	McGraw-Hill	1st Edition, 2004.
2	An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e	Grama, A. Gupta, G. Karypis, V. Kumar	Addison-Wesley	2nd Edition, 2003.

Additional Resources: Web links/NPTEL Courses

- **NPTEL Video : Parallel Computing**
  https://archive.nptel.ac.in/courses/106/102/106102114/
  https://www.nptelvideos.com/course.php?id=435
- **NPTEL Video : Introduction to Parallel Programming in OpenMP**
  https://archive.nptel.ac.in/courses/106/102/106102163/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7042.1	3	2	2									2		
21CSE7042.2	1	2	1	2	1			3						
21CSE7042.3	2		1											
21CSE7042.4		2		2	3	2			1	1	1	2		
21CSE7042.5		2		3		2								
21CSE7042.6			3		2				3			3		

1: Low 2: Medium 3: High

Natural Language Processing			
Course Code	**21CSE7043**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- To understand the different language models.
- 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 the natural language processing.

Module-1 Overview and Language Modelling (8 hours)

Overview: Origins and challenges of NLP Language, Grammar-Processing Indian Languages, NLP Applications, Information Retrieval, Some Successful Early NLP Systems.
Language Modelling: Introduction, Various Grammar-based Language Models, Statistical Language Model.
Textbook 1: Ch. 1,2.

Module-2 Word Level Analysis and Syntactic Analysis (8 hours)

Word Level Analysis: Introduction, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging.
Syntactic analysis: Introduction, Constituency Parsing, Parsing, Probabilistic Parsing**.**
Textbook 1: Ch. 3.1, 3.4 - 3.7,4.1, 4.3 - 4.5

Module-3 Semantic Analysis and Discourse Processing (8 hours)

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.
Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure.
Textbook 1: Ch. 5, 6

Module-4 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, Translation involving Indian Languages.
Textbook 1: Ch. 7, 8

Module-5 Information Retrieval and Lexical Resources (8 hours)

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval, Evaluation of the Information Retrieval System.
Lexical Resources: Introduction, WordNet, Stemmers, POS Tagger, Research Corpora.
Textbook 1: Ch. 9, 12

Course Outcomes: At the end of the course the student will be able :	
21CSE7043.1	To understand the origins and challenges of Natural language processing (NLP).
21CSE7043.2	To explore Parsing techniques, including Constituency parsing and Probabilistic parsing.
21CSE7043.3	To discuss the importance of Semantic analysis and Discourse processing in NLP.
21CSE7043.4	To understand the architecture of natural language generation (NLG) systems.
21CSE7043.5	To apply different Machine Translation approaches.

21CSE7043.6	To gain an overview of Information retrieval and Lexical resources in Natural language processing (NLP).

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
Reference Books				
1	Natural Language Processing with Python	Steven Bird, Ewan Klein, and Edward Loper	United States, O'Reilly Media	1st Edition, 2009
2	Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition	Daniel Jurafsky and James H Martin	Prentice Hall	2nd Edition, 2008
3	Natural Language Understanding	James Allen	Bejamin/cummings Publishing Co.	2nd Edition, 1995

Additional Resources: Web links/NPTEL Courses

- **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**	**PO12**	**PSO1**	**PSO2**
21CSE7043.1	2													
21CSE7043.2		2												
21CSE7043.3		2												
21CSE7043.4				2										
21CSE7043.5				2										
21CSE7043.6					2									

1: Low 2: Medium 3: High

Introduction to Cyber Security			
Course Code	**21CSE7051**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- To familiarize cybercrime terminologies and perspectives.
- To understand Cyber Offenses and Botnets
- To gain knowledge on tools and methods used in cybercrimes
- To understand phishing and identity theft
- To understand the Cyber forensics
- To recognize the various cybercrime and the measures to overcome those cybercrimes

Module-1 Introduction to Cybercrime (8 hours)

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes, Cybercrime: The Legal Perspective, Cybercrime: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspectives on Cybercrimes

Textbook:1 Chapter 1 (1.1 to 1.9)

Module-2 Cyber Offenses and Botnets(8 hours)

Cyber Offenses: How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafe & cybercrimes. Botnets: The fuel for cybercrime, Attack Vector.

Textbook:1 Chapter 2 (2.1 to 2.7)

Module-3 Tools and Methods used in Cybercrime (8 hours)

Tools and Methods used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key Loggers and Spyware, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDOS Attacks, SQL Injection, Attacks on Wireless networks.

Textbook:1 Chapter 4 (4.1 to 4.10, 4.12)

Module-4 Phishing and Identity Theft (8 hours)

Phishing and Identity Theft: Introduction, Phishing: Methods of Phishing, Phising Techniques, Spear Phishing, Types of Phishing Scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures, Identity Theft: Personally Identifiable Information(PII), Types of Identity Theft, Techniques of ID Theft, Identity Theft: Countermeasures.

Textbook:1 Chapter 5 (5.1. to 5.3)

Module-5 Computer Forensics (8 hours)

Computer Forensics: Introduction, Historical Background of Cyber Forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensic Analysis of E-Mail, Digital Forensic Life cycle, Chain of Custody Concepts, Network Forensics.

Textbook:1 Chapter 7 (7.1. to 7.9)

Course Outcomes: At the end of the course the student will be able :	
21CSE7051.1	Explain the cybercrime terminologies and the various cyber laws.
21CSE7051.2	Describe Cyber offenses and Botnets
21CSE7051.3	Illustrate Tools and Methods used on Cybercrime
21CSE7051.4	Explain phishing and identity thefts
21CSE7051.5	Illustrate the need of cyber forensics
21CSE7051.6	Justify the measures to overcome the cybercrimes

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Sunit Belapure and Nina Godbole	Wiley India Pvt Ltd,	1st Edition, 2018
Reference Books				
1	Introduction to Security and Network Forensics	Buchanan, William J. (2011)	CRC Press	1st Edition, 2011
2	Principles of Information Security	Michael E. Whitman, Herbert J. Mattord,	Cengage Learning Pub	2nd Edition 2012

Additional Resources: Web links/NPTEL Courses

- https://youtu.be/hXSFdwIOfnE
- https://onlinecourses.nptel.ac.in/noc23_cs127/preview
- https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE7051.1			1			1								
21CSE7051.2			2			2								
21CSE7051.3			1			1								
21CSE7051.4			1			1								
21CSE7051.5			1			1								
21CSE7051.6			1			1								

1: Low 2: Medium 3: High

Introduction to Data Structures			
Course Code	**21CSE7052**	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 Hours
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Analyze the basics of Data structure and the applications
- Implement Data structures of Stack and Queue to solve real world problems
- Demonstrate the graphs and trees in Data structure to implement the real world problems
- Demonstrate of Data structure to implement Hashing and Collision

Module-1 Introduction to Data Structures (8hours)

Basic Concepts: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions and Polynomials.
Strings: Basic Terminology, Storing, Operations, and Pattern Matching algorithm.
TextBook1: Ch2.1-2.3,5.1-5.3,5.5-5.6,4
TextBook2: Ch1.2,2.4

Module-2 Stacks and Queues (8 hours)

Stacks: Definition, Array Representation of Stacks and Stack Operations. Stack Applications: Polish notation, Infix to postfix conversion, Evaluation of postfix expression.
Queues: Definition, Array Representation, Queue Operations, Circular Queues
TextBook1:ch 7.1-7.3,7.7,8.1-8.3,8.4.1

Module-3 Linked Lists (8 hours)

Single Linked List: Definition, Representation of linked lists in Memory.
Operations: Insertion, Deletion, Traversing, and Searching.
Doubly Linked lists: Definition, Representation of linked lists in Memory.
Operations: Insertion, Deletion, Traversing, and Searching.
TextBook1:ch 6.2,6.4,6.8

Module-4 Graphs and Trees (8hours)

Graphs: Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search.
Trees: Introduction, Binary Trees, Binary Tree Traversals**,** Additional Binary Tree Operations, Binary Search Trees.
TextBook1: ch 13.1,13.2,13.5.1-13.5.2,13.6
TextBook1: ch 9.1,9.2.3,9.2.4,9.4

Module-5 Hashing and Collision (8 hours)

Hashing and Collision: Introduction, Hash Tables, Hash Functions, Different Hash Functions, Collisions, Pros and Cons of Hashing, Applications of Hashing
Textbook1: ch 15.1-15.7

Course Outcomes: At the end of the course the student will be able to:	
21CSE7052.1	Analyze the fundamentals of data structures (arrays and structures) for data organization and traversal.
21CSE7052.2	Analyze and Implement organization of data using the data structures Stacks and Queues.
21CSE7052.3	Implement organization of data using the data structures Singly Linked List.

21CSE7052.4	Implement organization of data using the data structures Doubly Linked List.
21CSE7052.5	Apply trees and graphs for data ordering, data searching and evaluating expressions.
21CSE7052.6	Demonstrate data structure to implement Hashing and Collision and Applications.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Structures using C	Reema Thareja	Oxford University press	2nd Edition, 2014
2	Fundamentals of Data Structures in C -	Ellis Horowitz and Sartaj Sahni	Universities Press,	2nd Edition, 2008
Reference Books				
1	Data Structures using C	Aaron M.Tenenbaum, YedidyahLangsam, Moshe J.Augenstein	Pearson education	Low price edition, 2009
2	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Cengage Learning	2nd Edition, 2005

Web links and Video Lectures (e-Resources):

- **Linked List:** https://www.academia.edu/42067890/Data_Structures_Using_C_2e_Reema_Thareja Overall Concepts
- **NPTEL:** Computer Science and Engineering – Data Structures And Algorithms Stacks and Queues: https://www.simplilearn.com/tutorials/data-structure-tutorial/stacks- and-queues

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE7052.1	2	2	1	1			1							
21CSE7052.2	2	2	1	1			1							
21CSE7052.3	2	2	1	1			1							
21CSE7052.4	2	2	1	1			1							
21CSE7052.5	2	2	1	1			1							
21CSE7052.6	2	2	1	1			1							

1: Low 2: Medium 3: High

Operating System			
Course Code	**21CSE7053**	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 Hours
Total Hours	40 hours	Credits	03

Course Learning Objectives:

- Demonstrate the need for Operating system, types and services.
- Apply suitable techniques for the management of various resources.
- Use Processor, Memory, Storage and File system command
- Demonstrates the use of Memory and Virtual memory management.
- Analyze the concept of Deadlock and Process synchronization.

Module-1 Introduction to Operating Systems (8 hours)

Introduction to operating systems: What Operating Systems Do: User View, System View, Computer-System Operation: Computer-System Operation, Storage Structure, I/O Structure, Computer-System Architecture: Single-Processor Systems, Multiprocessor Systems, Clustered Systems, Operating System Structure: Multiprogramming, Timesharing, Operating-System Operations: Dual-Mode and Multimode Operation, Timer, Protection and Security, Computing Environments: Traditional Computing, Mobile Computing, Distributed Systems, Client–Server Computing, Peer-to-Peer Computing, Virtualization, Cloud Computing, Real-Time Embedded Systems.

Chapters: 1 (1.1 – 1.5, 1.9, 1.11)

Module-2 , Operating System Services and Process (8 hours)

Operating System Services: Operating-System Services, System Calls, Types of System Calls: Process Control, File Management, Device Management, Information Maintenance, Communication, Protection, System Programs, Operating-System Structure: Simple Structure, Layered Approach, Microkernels, Modules, Hybrid Systems.

Process: Process concept: The Process, Process State, Process Control Block, Threads, Process Scheduling: Scheduling Queues, Schedulers, Context Switch

Chapters: 2 (2.1, 2.3 – 2.5, 2,7) and 3 (3.1 – 3.2)

Module-3 Process Operations and Synchronization (8 hours)

Process: Operations on Processes: Process Creation, Process Termination, Interprocess Communication: Shared-Memory Systems, Message-Passing Systems.

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores: Semaphore Usage, Semaphore Implementation, Deadlocks and Starvation, Priority Inversion, Classic Problems of Synchronization: The Bounded-Buffer Problem, The Readers–Writers Problem, The Dining-Philosophers Problem

Chapters: 3 (3.3 – 3.4) and 5 (5.2 – 5.7)

Module-4 CPU Scheduling (8 hours)

CPU Scheduling: Basic Concepts: CPU–I/O Burst Cycle, CPU Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms: First-Come, First-Served Scheduling, Shortest-Job-First Scheduling, Priority Scheduling, Round-Robin Scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling.

Chapters: 6 (6.1 – 6.3)

Module-5 Deadlocks (8 hours)

Deadlocks: System Model, Deadlock Characterization: Necessary Conditions, Resource-Allocation Graph, Methods for Handling Deadlocks, Deadlock Prevention: Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait, Deadlock Avoidance: Safe State, Resource-Allocation-Graph Algorithm, Banker's Algorithm, Deadlock Detection: Single Instance of Each Resource Type,

Several Instances of a Resource Type, Detection-Algorithm Usage, Recovery from Deadlock: Process Termination, Resource Preemption. **Chapters: 7 (7.1 – 7.7)**

Course Outcomes: At the end of the course the student will be able :	
21CSE7053.1	Ability to analyze the design of Operating System operations and Services.
21CSE7053.2	Demonstrates Process Management and Multi-threaded programming.
21CSE7053.3	Illustrate the mechanism of Process Synchronization.
21CSE7053.4	Interpret the concepts inter process communication.
21CSE7053.5	Implementation of CPU scheduling alogoritms.
21CSE7053.6	Analyse and handle the deadlocks.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	Wiley-India	9th Edition, 2012
Reference Books				
1	Operating Systems: Internals and Design Principles	William Stallings	Pearson	6th Edition, 2012
2	Modern Operating Systems	Andrew S. Tannenbaum and Herbert Bos	Pearson	4th Edition, 2015

Additional Resources: Web links/NPTEL Courses

- https://www.geeksforgeeks.org/operating-systems
- https://www.codingninjas.com/courses/operating-system
- https://www.udacity.com/course/introduction-to-operating-systems--ud923

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE7053.1										2				2
21CSE7053.2										2			2	
21CSE7053.3										2			2	
21CSE7053.4						2					2			2
21CSE7053.5	2					2					2			2
21CSE7053.6			2								2			

1: Low 2: Medium 3: High

Technical Seminar			
Course Code	**21CSS706**	CIE Marks	100
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	-
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE	-
Total Hours	20 hours	Credits	01

Course Learning Objectives:

1. To equip students with the ability to conduct in-depth research, analyze technical literature, and explore contemporary advancements in their field of study.
2. To effectively organize, design, and deliver technical presentations that convey complex information clearly to a diverse audience.
3. To encourage students to critically analyse and evaluate emerging trends, technologies, or methodologies relevant to their chosen seminar topic.
4. To enable students to improve their written and oral communication by preparing well-structured seminar reports and articulating ideas confidently during presentations.
5. To stimulate independent learning and problem-solving abilities by allowing students to explore specific topics of interest, enhancing self-directed research and learning.
6. To prepare students to effectively discuss and defend their technical knowledge in a professional setting, such as viva-voce, aligning with future industry or academic pursuits.

1. Selection of Technical Seminar Topic

- Students should select a technical topic related to their field of study, preferably focusing on recent advancements or emerging technologies. Inter-disciplinary/Multi-disciplinary topics are appreciated.
- Topics must be approved by the seminar coordinator within the first few weeks of the semester.

2 Research and Preparation

- Extensive research should be carried out using credible sources such as research papers, technical journals, books, and online databases.
- A minimum of 10-20 references is recommended, ensuring a mix of primary and secondary sources.

3. Seminar Report

- A detailed report (approximately 20-30 pages) must be prepared, summarizing the research findings and organized in a structured manner.
- The report should include sections like introduction, literature review, methodology, results, discussion, conclusion, and references.
- The report should follow a standard format as prescribed by the Department (font, spacing, citation style, etc.).

4. Oral Presentation

- Students must deliver an oral presentation lasting 15-20 minutes, followed by a question-and-answer session.
- Presentations should be well-structured, with appropriate use of visuals (slides, graphs, diagrams) to clearly convey technical content.
- All presentations must be conducted on scheduled dates, and attendance is mandatory for both presenters and all other students.

5. Question and Answer Session

- After the presentation, students will face a viva-voce where they are required to answer questions posed by the Departmental Seminar Evaluation Committee regarding their seminar topic.
- The viva will test the student's depth of understanding, research analysis, and ability to think critically about the subject matter.

6. Evaluation Criteria
• **Seminar Report**: Clarity, technical depth, comprehensiveness, quality of research, organization, and adherence to format (50 marks). • **Oral Presentation**: Communication skills, visual aids, clarity of content, timing, etc. (25 marks). • **Viva-Voce**: Ability to answer questions effectively, depth of understanding, and analytical skills (25 marks).
7. Submission Deadlines
• The report should be submitted at least one week prior to the scheduled presentation date. • Late submissions will be penalized as per department rules.
8. Plagiarism Check
• All seminar reports must be subjected to plagiarism checking, and the similarity index should be within acceptable limits specified by the Department. • Instances of plagiarism will result in penalties, which could include rejection of the report or a reduction in marks.
9. Mentorship and Feedback
• Students are required to consult with their faculty mentors regularly throughout the preparation phase to seek guidance and feedback. • At least three mentorship meetings should be recorded before the final presentation.
10. Attendance
• Students must attend all seminar sessions conducted by their peers, as it promotes collaborative learning and constructive feedback. • Attendance could be considered for internal evaluation.

Course Outcomes: At the end of the course the student will be able to :	
21CSS706.1	Demonstrate a thorough understanding of a specialized topic by conducting extensive research and presenting technical content effectively.
21CSS706.2	Exhibit proficiency in delivering well-organized and visually supported oral presentations, clearly articulating complex technical ideas to an audience.
21CSS706.3	Apply critical thinking and research methodologies to explore, analyze, and synthesize information from various sources, leading to sound conclusions.
21CSS706.4	Prepare a detailed and well-structured seminar report that adheres to technical writing standards, showcasing the ability to document research findings comprehensively.
21CSS706.5	Respond confidently and competently to questions during the viva-voce, defending the technical work and demonstrating an in-depth understanding of the topic.
21CSS706.6	Engage actively in peer seminars, providing constructive feedback, and reflecting on insights gained from discussions with fellow students and faculty.

Useful Links:
• https://homes.cs.washington.edu/~mernst/advice/giving-talk.html (How to give a technical presentation) • https://learnerbits.com/essential-tips-for-engineering-presentations • https://onlinecourses.nptel.ac.in/noc24_hs175/preview (Technical English for Engineers)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSS706.1	-	1	-	3	-	-	-	-	-	2	-	-	-	-
21CSS706.2	-	-	-	-	2	-	-	-	-	3	-	1	-	-
21CSS706.3	-	2	-	3	-	-	-	-	-	-	-	-	-	-
21CSS706.4	-	-	-	-	-	1	-	2	-	3	-	-	-	-
21CSS706.5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
21CSS706.6	-	-	-	-	-	1	-	-	-	3	-	2	-	-

1: Low 2: Medium 3: High

Major Project Work			
Course Code	**21CSP707**	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	60 hours	Credits	05

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 Selection

- **Relevance**: Projects should align with the students' specialization and current industry trends.
- **Innovation**: Projects that offer innovative solutions to existing problems or explore new ideas are encouraged.
- **Feasibility**: The project should be achievable within the given timeframe and resources.
- **Team Composition**: Students can work in teams, typically comprising maximum 4 members.

2. Project Proposal

- **Submission**: Students must submit a detailed project proposal (project synopsis) outlining the problem statement, objectives, methodology, expected outcomes, and a work plan.
- **Approval**: The proposal should be reviewed and approved by the Department Project Evaluation Committee (DPEC).

3. 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.

4. 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.

5. Final Submission

- **Report**: The final 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.

6. 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.

7. 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.

8. 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%).

9. 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.

10. 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 50 marks)**
1. Project Synopsis Evaluation (Phase I)	Beginning of the 7th Semester	10 marks
2. Project Progress Evaluation	Middle of the 7th Semester	20 marks
3. Project Report Evaluation (Phase II)	End of the 7th Semester	20 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.		
• When all the Project Objectives are met and the Project Work is successfully completed and final Project Report is submitted as reported by the Department Project Evaluation Committee (DPEC), the CIE and SEE performance of the 7th semester will be carried forward to the 8th semester. There will not be any separate CIE and SEE for such project batches in the 8th semester.		

- In case of any Project Objectives not met, Project Work not completed or final Project Report not submitted, as reported by the DPEC, the CIE and SEE will be conducted in the 7th semester for the completed portion of the Project Work. In such cases, the submission of the Draft Copy of the Project Report is mandatory for evaluation. The remaining part of the project shall be completed during the 8th semester and there will be a CIE and SEE for the Project Work in the 8th semester.

Students are advised to complete the Project Work during the 7th semester and devote the 8th semester for Industry Internship/Research Internship.

Course Outcomes: At the end of the course the student will be able to :	
21CSP707.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
21CSP707.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
21CSP707.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
21CSP707.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
21CSP707.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
21CSP707.6	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**
21CSP707.1	**2**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21CSP707.2	**-**	**-**	**3**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21CSP707.3	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21CSP707.4	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**2**	**2**	**-**	**-**	**-**
21CSP707.5	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
21CSP707.6	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**-**	**-**

1: Low 2: Medium 3: High

VIII Semester

Massive Open Online Course (MOOC)			
Course Code	**21AEC801**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE	3 Hrs
Total Hours	20 hours	Credits	02

Course Learning Objectives:

1. Enable students to acquire a strong foundation in core engineering subjects through high-quality, accessible online resources.
2. Facilitate skill development in specific engineering domains using practical exercises, simulations, and projects offered through the MOOC platform.
3. Encourage students to develop autonomy in learning by navigating and managing their course content, assignments, and assessments independently.
4. Expose students to interdisciplinary concepts and applications, fostering an understanding of how engineering principles integrate with other fields.
5. Provide exposure to global best practices and trends in engineering, allowing students to learn from international faculty and peer collaboration.
6. Develop essential soft skills by participating in discussion forums, group projects, and peer assessments, enhancing communication and teamwork skills.

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 2 credits. Typically, 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 enrol for one 8-weeks MOOCs course to earn 2 credits. However, Students can also take two 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied.

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 :	
21AEC801.1	Students will demonstrate a strong grasp of essential engineering concepts and methodologies relevant to their chosen field.
21AEC801.2	Students will apply engineering knowledge to solve real-world problems through projects and case studies presented in the course.
21AEC801.3	Students will proficiently use online tools and resources, including simulations, interactive modules, and digital libraries, to enhance their learning experience.
21AEC801.4	Students will gain insights into new technologies and innovations within engineering, preparing them to adapt to technological advancements.

21AEC801.5	Students will exhibit improved teamwork and communication skills by engaging in online discussions, group projects, and peer assessments.
21AEC801.6	Students will develop a broader understanding of how engineering intersects with other disciplines and cultural contexts, informed by national/global perspectives gained through the MOOC.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21AEC801.1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21AEC801.2	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
21AEC801.3	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
21AEC801.4	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
21AEC801.5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**1**	**-**	**-**
21AEC801.6	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Low 2: Medium 3: High

Major Project Work			
Course Code	**21CSP802**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE	3 Hrs
Total Hours	20 hours	Credits	05

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. Progress 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 final 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 50 marks)**
1. Progress Review	During the 8th semester	25 marks
2. Project Report Evaluation	End of the 8th Semester	25 marks
Semester End Examinations (SEE)		
3. 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 :	
21CSP802.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
21CSP802.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
21CSP802.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
21CSP802.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
21CSP802.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
21CSP802.6	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
21CSP802.1	2	3	-	-	1	-	-	-	-	-	-	-	-	-
21CSP802.2	-	-	3	-	-	2	1	-	-	-	-	-	-	-
21CSP802.3	1	2	-	3	-	-	-	-	-	-	-	-	-	-
21CSP802.4	-	-	-	-	-	1	-	-	3	2	2	-	-	-
21CSP802.5	-	-	1	-	-	-	2	3	-	-	-	-	-	-
21CSP802.6	-	-	-	-	-	-	-	-	-	3	2	1	-	-

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**21INT803**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	15 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:	
21INT803.1	Apply appropriate research methodologies and tools to design and conduct experiments, analyze data, and draw conclusions.
21INT803.2	Demonstrate the ability to identify and solve complex engineering problems through innovative and systematic research approaches.
21INT803.3	Acquire proficiency in using advanced technologies, tools, and techniques relevant to their field of research.
21INT803.4	Develop skills in writing comprehensive research reports, documentation, and effectively presenting research findings.
21INT803.5	Understand and apply ethical standards in research, including plagiarism avoidance, proper citations, and data integrity.
21INT803.6	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://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf

3. VTU Mandatory Internship Guidelines 2021.
Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21INT803.1	**1**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21INT803.2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21INT803.3	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
21INT803.4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**1**	**-**	**-**
21INT803.5	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**
21INT803.6	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**-**	**-**	**-**

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**21INT803**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	15 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:	
21INT803.1	Apply engineering concepts and theoretical knowledge to solve real-world industry problems.
21INT803.2	Enhance their problem-solving abilities by identifying, analyzing, and providing innovative solutions to engineering challenges in the industry.
21INT803.3	Develop key professional skills such as teamwork, communication, and time management in a corporate or industrial environment.
21INT803.4	Gain exposure to industry-standard tools, technologies, methodologies, and regulatory standards relevant to their field of study.
21INT803.5	Demonstrate understanding and adherence to professional ethics, safety regulations, and responsibilities in an industrial setting.
21INT803.6	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://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf

3. VTU Mandatory Internship Guidelines 2021.
Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21INT803.1	3	2	-	-	-	1	-	-	-	-	1	-	-	-
21INT803.2	-	3	2	1	-	-	-	-	-	-	1	-	-	-
21INT803.3	-	-	-	-	-	-	-	-	3	2	-	-	-	-
21INT803.4	-	-	-	-	3	2	-	-	-	-	-	1	-	-
21INT803.5	-	-	-	-	-	2	-	3	-	-	-	-	-	-
21INT803.6	-	-	-	-	-	-	-	-	2	3	-	1	-	-

1: Low 2: Medium 3: High

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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

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi
Accredited by NAAC with A+ Grade
B.E. (CSE, ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

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