Third 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) & MBA
NAAC – Accredited with A+

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

Computer Science and Engineering

THIRD YEAR

(V and VI 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 MBA 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.

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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.

V Semester (B.E. - CS 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**	
						L	T	P					
1	HSMC	21CSE501	Software Engineering and Project Management	CSE	CSE	3	-	-	03	50	50	100	3
2	PCC	21CSE502	Computer Networks (Integrated)	CSE	CSE	3	-	2	03	50	50	100	4
3	PCC	21CSE503	Automata Theory and Computability	CSE	CSE	2	2	-	03	50	50	100	3
4	PCC	21CSE504	Big Data and Analytics	CSE	CSE	2	2	-	03	50	50	100	3
5	PCC	21CSE505	Artificial Intelligence and Machine Learning	CSE	CSE	2	2	-	03	50	50	100	3
6	PCC	21CSL506	Artificial Intelligence and Machine Learning Laboratory	CSE	CSE	-	-	2	03	50	50	100	1
7	HSMC	21RMI507	Research Methodology and Intellectual Property Rights	CSE	CSE	3	-	-	03	50	50	100	3
8	INT	21INT508	Summer Internship - II	CSE	CSE	-	-	-	03	100	-	100	2
9	MNCC	21ETP509	Emerging Technologies: A Primer	COM	COM	-	-	2	02	50	-	50	-
						15	6	6	26	500	350	850	22

Note: BSC: Basic Science Courses; ESC: Engineering Science Courses; HSMC: Humanity, Social Science and Management Courses; MNCC = Mandatory Non-Credit Course. INT: Internship, PCC: Professional Core Course; PEC = Professional Elective Course; OEC = Open Elective Course; UHV: Universal Human Values SDC: Ability Enhancement (Skill Development) Course.

One-hour Lecture (L) per week per semester = 1 Credit; Two-hour Tutorial (T) per week per semester = 1 Credit; Two-hour Practical/Laboratory/Drawing (P) per week per semester = 1 Credit.

VI Semester (B.E. - CS 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**	
						L	T	P					
1	PCC	21CSE601	System Software and Compiler Design (Integrated)	CSE	CSE	3	-	2	03	50	50	100	4
2	PCC	21CSE602	Full Stack Development	CSE	CSE	3	-	-	03	50	50	100	3
3	PEC	21CSE603X	Professional Elective - 1	CSE	CSE	3	-	-	03	50	50	100	3
4	OEC	21XXX604X	Open Elective - 1	CSE	CSE	3	-	-	03	50	50	100	3
5	HSMC	21CIV605	Environmental Studies	CIV	CIV	1	-	-	02	50	50	100	1
6	PCC	21CSL606	Web Programming Laboratory	CSE	CSE	-	-	2	03	50	50	100	1
7	PCC	21CSE607	Cryptography and Cyber Security	CSE	CSE	3	-	-	03	50	50	100	3
8	SDC	21CSE608	Mini-Project	CSE	CSE	-	-	2	03	100	-	100	2
9	MNCC	21IIP609	Innovation and Intellectual Property	COM	COM	-	-	2	02	50	-	50	-
10	INT	Summer Internship III: Research Internship / Industrial Internship: 24 weeks during the VI to VIII semesters On successful completion, 10 credits will be added in the VIII Semester marks card.											
						16	-	08	25	500	350	850	20

Professional Elective - I: Students can select any one of the Professional Electives offered by the Department.

Professional Elective – 1 21CSE603X			
21CSE6031	Discrete Mathematical Structures	21CSE6033	Blockchain Technology
21CSE6032	Deep Learning	21CSE6034	Agile Technology

Open Elective I (21XXX604X)							
Course Code	**CSE**	**AIM**	**CBS**	**ECE**	**EEE**	**MEC**	**CIV**
21XXX6041	Introduction to Database Management System	Neural Networks	Neural Networks	Basics of Analog Circuits	Renewable Energy Sources	Automobile Engineering	Remote Sensing and Geographical Information System
21XXX6042	Introducton to Programming in Java	Introductionto AI and ML	Introductionto AI and ML	Fundamentals of Digital System Design	PLC & SCADA	3D modelling	Numerical Methods and Applications
21XXX6043	Dot Net Programming	ComputerVision	ComputerVision	Microcontroller	Control Systems	Entrepreneurship Development	Sustainability Concepts in Engineering
21XXX6044	Introduction to Python	Predictive Analytics	Predictive Analytics	Programming & Interfacing with Arduino	Electrical Safety Practices	Statistical Quality Control	Occupational Health and Safety
21XXX6045	-	Introduction to Data Science	Introduction to Data Science	Communication Theory	Energy Conservation and Audit	Non-Destructive Testing	-

Note: Open Elective – I: Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives). Selection of an open elective shall not be allowed if, (i) the candidate has studied the same course during the previous semesters of the program. (ii) the syllabus content of open elective is similar to that of the Departmental core courses or professional electives. (iii). A similar course, under any category, is prescribed in the higher semesters of the program. Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Research/Industrial Internship - All the students admitted shall have to undergo a mandatory internship of minimum 24 weeks during the VI to VIII semesters. Viva-Voce examination shall be conducted during VIII semester and the prescribed credit shall be included. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

Research Internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give students the flavour of current research going on a particular topic/s. The internships serve this purpose. They help students to get familiarized with the field, the skill needed, the amount and kind of effort required for carrying out research in that field.

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.

V Semester

Software Engineering and Project Management			
Course Code	**21CSE501**	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: The objective of the course is to

- Outline software engineering principles and activities involved in building large software programs
- Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation
- Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems
- Describe the intricacies involved in software evolution and the need for software testing.

Module-1 Phases and Life cycle models of Software Development (8 hours)

Introduction: Professional software development; Software engineering: ethics and case studies
Software processes: Software processes Models; The waterfall model, Incremental development, Integration and configuration.
Applications: Identifying phases and Life cycle models of Software Development
Text book 1: Chapter 1: 1.1-1.3 Chapter 2: 2.1

Module-2 Software Process activities, Agile software Development and Requirements Analysis (8 hours)

Process activities: Software specification, Software design and implementation, Software validation, Software evolution.
Agile Software development: Agile methods, Agile development techniques, Extreme Programming, Agile project Management
Software requirements: Functional and non-functional requirements; Requirements engineering Process, Requirement elicitation, Requirement specification, Requirement Validation and management
Applications: Systematically identifying the requirements and using agile method for software development
Text book 1: Chapter 2: 2.2 Chapter 3: 3.1-3.3, Chapter 4: 4.1-4.6

Module-3 System Modeling(8 hours)

System models: Context models; Interaction models; sequence diagram Structured methods; class diagram, generalization, Aggregation. Behavioral Models-Data driven modeling; Event driven modeling, Model driven engineering
Applications: Concept learning to develop system models based on software requirements.
Text book 1: Chapter 5: 5.1-5.5

Module-4 Software Design and Testing (8 hours)

Software Design: Object-oriented design using the UML, Design Patterns, Implementation Issues.
Software testing: Development testing, Test-driven development, Release testing, User testing.
Applications: Selecting the right method for testing a software and maintaining the system.
Text book 1: Chapter 7: 7.1-7.3 Chapter 8: 8.1-8.4

Module-5 and Evolution of Software and Project Management (8 hours)

Software evolution: Evolution processes, Legacy system management.
Project management: Risk management, Project planning: Software pricing, Plan-driven development, Quality management: Software quality, Software standards. Configuration management: Change management, Version management, System building, Release management

Applications: Managing a software by analyzing the risk involved and maintaining its quality while undergoing a change.
Text book 1: Chapter 9: 9.1-9.2 Chapter 22: 22.1 Chapter 23: 23.1-23.2 Chapter 24: 24.1-24.2 Chapter 25: 25.1-25.4
Additional Resources: Software development tools: Jira, Eclipse IDE, GitHub, Docker

Course Outcomes: At the end of the course the student will be able to:	
21CSE501.1	Describe software process models and apply them in software development scenarios.
21CSE501.2	Describe software process activities and develop a plan for requirement engineering for agile method of software development
21CSE501.3	Apply object orientation and modeling constructs to design modeling diagrams for software systems.
21CSE501.4	Differentiate between various software testing methods and select the right method for testing a software.
21CSE501.5	Apply the principals involved in software evolution while maintaining a software and describe the processes involved in project planning and quality management.
21CSE501.6	Function effectively in teams to develop software specification document, system models, and test cases while implementing a systematic approach to problem solving.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Software Engineering	Ian Somerville	Pearson Education Ltd	10th Edition, 2017
Reference Books				
1	An Integrated Approach to Software Engineering	Pankaj Jalote	Springer	3rd Edition, 2005
2	Object Oriented Modelling and Design with UML	Michael Blaha, James Rumbaugh	Pearson Education	2nd Edition, 2005
3	Software Engineering-A Practitioners approach	Roger S. Pressman	Tata McGraw Hill	7th Edition, 2009

Web links and Video Lectures (e-Resources):

- **Software Engineering Essentials:** https://www.edx.org/course/software-engineering-essentials
- **Basics to Advanced fundamentals of SE:** https://www.udemy.com/the-complete-software-engineering-from-basics-to-advanced/
- **Agile Software Development:** https://www.udemy.com/fundamentals-of-agile-software-development/
- **Scrum Master Tales:** https://www.udemy.com/scrumtalesstoriesfromascrummastersdiary/
- **Test your agile and scrum knowledge:** https://www.udemy.com/test-your-agile-and-scrum-knowledge/?couponCode=DISCUDEMY.COM

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE501.1	3		1				1							1
21CSE501.2	3			1			1							
21CSE501.3		2	1	2										1
21CSE501.4		2	1	2	1				1	1				1
21CSE501.5			1	2	1									1
21CSE501.6			1					2	2	3	1			

1: Low 2: Medium 3: High

Computer Networks			
Course Code	**21CSE502**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

Develop knowledge of network elements and associated network layer protocols and uses of computer networks.

Analyze various network layers design issues and its quality-of-service requirements.

Apply the knowledge of computer networking to develop network applications.

Develop the knowledge of computer networking modern tools and technological advancements.

Module-1 Introduction (8 hours)

Uses of computer networks: Business Applications, Home Application, Mobile Users, Social Issues; Network hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Home Networks, Internet works; Network software: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Services, Service Primitives. Reference Models: OSI Reference Model and TCP/IP Reference Model.

Chapter 1: 1.1-1.3, 1.4.1, 1.4.2

Module-2 Network Layer - Routing and Congestion Control (8 hours)

Routing algorithms: The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad hoc Networks.

Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control.

Chapter 5: 5.2, 5.3

Module-3 Quality of Service in Networks and Internetworking (8 hours)

Quality of Service: Application Requirements, Traffic Shaping, Packet Scheduling, Admission Control, Integrated Services, Differentiated Services.

Internetworking: How networks differ, How Networks Can Be Connected, Tunneling, Internetwork Routing, Fragmentation**;** The Network Layer in the Internet: The IPv4 Protocol, IP Addresses, IPv6, Internet Control Protocols, OSPF, BGP, Internet Multicasting, IPV6.

Chapter 5: 5.4, 5.5, 5.6: 5.6.1-5.6.4, 5.6.6-5.6.8

Module-4 The Transport Layer (8 hours)

The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives, An Example of Socket Programming. **Elements of Transport Protocols:** Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery; **The Internet Transport Protocols (UDP and TCP):** Introduction to UDP, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, and Sliding Window protocols, TCP Congestion Control.

Chapter 6: 6.1,6.2,6.4,6.5

Module-5 The Application Layer (8 hours)

The Domain Name System DNS: The DNS Name Space, Domain Resource Records, Name Servers, **Electronic Mail:** Architecture and Services, The User Agent, Message Formats, Message Transfer**,** Final delivery

WWW: Architectural overview, Static Web Pages, Dynamic Web Pages and Web Applications. HTTP (Hypertext Transfer Protocol), Mobile Web, Web Search.

Chapter 7: 7.1, 7.2, 7.3

PRACTICAL

A–Demonstration (Compulsorily to be conducted):

A1. Implement three nodes point–to–point networks with duplex links between them using NS2. Set the queue size, vary the bandwidth, and find the number of packets dropped.

A2. Implement transmission of ping messages/traceroute over a network topology consisting of 6 nodes using NS2 and find the number of packets dropped due to congestion.

A3. Implement a program to study the performance of GSM on NS2.

A4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation using NS2 and determine the performance with respect to the transmission of packets.

B–Exercise (compulsorily to be conducted):

B1. Write a program for error detecting code using CRC-CCITT (16- bits).

B2. Write a program to find the shortest path between vertices using the bellman-ford algorithm

B3. Write a program for congestion control using a leaky bucket algorithm.

B4. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

C–Structured Enquiry (compulsorily any 2 to be conducted):

C1. Analyze network packets using Wireshark (IPv6, Ipv4, ICMP, and ICMP6).

C2. Implement an Ethernet LAN using n nodes and set multiple traffic nodes using NS2 and plot conges the window for different source/destination.

C3. Develop a program such that client will send a simple ping message to a server and receive a corresponding pong message back from the server using any programming message.

C4. Implement IPv4 address classifier (A, B, C, D, and E) using any programming language.

D–Open Ended Experiments (any one):

D1. Implement simple FTP protocol using any programming language.

D2. Create IPv4 or IPv6 packets using any programming language.

D3. Implement IPv4 router using any programming language.

D4. Implement packet sniffer using any programming language.

Course Outcomes: At the end of the course the student will be able to:	
21CSE502.1	Identify various uses of networks, Design issue of network layers, and summarize its quality-of-service requirements.
21CSE502.2	Illustrate various routing and congestion control algorithms.
21CSE502.3	Outline the internet protocol's structure and demonstrate the working of internet protocols.
21CSE502.4	Identify transport layer services and show the working of transport layer protocols.
21CSE502.5	Appraise application layer protocols.
21CSE502.6	Apply modern networking tools.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Computer Networks	Andrew S. Tanenbaum David J. Wetherall	Pearson	5th Edition, 2014
Reference Books				
1	Computer Networking. A Top-Down Approach	Kurose and Ross	Tata McGraw-Hill	5th Edition, 2010

2	Computer Networks: A Systems Approach	Bruce S. Davie and Larry L. Peterso	The Morgan Kaufmann Series in Networking	5th Edition, 2011

Web links and Video Lectures (e-Resources):

- **Computer Networks and Internet Protocol, IIT Kharagpur:** https://www.youtube.com/playlist?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up
- **TCP/IP Tutorial and Technical Overview:** https://www.redbooks.ibm.com/redbooks/pdfs/gg243376.pdf
- **RFCs:** http://www.ietf.org/rfc.html
- **Computer Networks:** https://www.cse.iitk.ac.in/users/dheeraj/cs425/
- **Web Resources for Computer Networks, 5/e:** https://www.cs.vu.nl/~ast/CN5/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE502.1														
21CSE502.2	2				2									2
21CSE502.3														
21CSE502.4														
21CSE502.5			2			2								2
21CSE502.6					3				1					2

1: Low 2: Medium 3: High

Automata Theory and Computability			
Course Code	**21CSE503**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Introduce core concepts in Automata and Theory of Computation
- Identify different Formal Language Classes and their Relationships
- Design Grammars and Recognizers for different formal languages
- Prove or disprove theorems in automata theory using their properties
- Determine the decidability and intractability of Computational problems

Module-1 Basic Concepts of Automata Theory (8 hours)

Languages and Strings: Strings, Languages.
Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing DFSM, Nondeterministic FSMs, From FSMs to Operational Systems, Minimizing FSMs, Finite State Transducers.
Textbook 1: Chapter 2, Chapter 5: 5.1-5.5, 5.7.2, 5.9

Module-2 Regular Expressions and Languages (8 hours)

Regular Expressions (RE): What is a RE? Kleene's theorem,
Regular Grammars: Definition, Regular Grammars and Regular Languages.
Regular and Nonregular Languages: How many RLs? Showing that a language is regular, Closure properties of RLs.
Textbook 1: Chapter 6: 6.1-6.2(6.2.1-6.2.3),, Chapter 7: 7.1-7.2, Chapter 8: 8.1-8.3

Module-3 Context-Free Grammars and PDA (8 hours)

Context-Free Grammars (CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, Simplifying CFGs, Derivations and Parse trees, Ambiguity, Normal Forms.
Pushdown Automata (PDA): Definition of Non-deterministic PDA, Deterministic and Non-deterministic PDAs.
Textbook 1: Chapter 11: 11.1, 11.2, 11.4, 11.6-11.8, Chapter 12: 12.1-12.2

Module-4 Decision Procedures for CFLs and Turing Machines (8 hours)

Algorithms and Decision Procedures for CFLs: Decidable questions, Undecidable questions.
Turing Machine: Turing machine model, Representation, Language acceptability by TM, Design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata.
Textbook 1, Chapter 14: 14.1-14.2, Textbook 2: Chapter 9: 9.1-9.4, 9.6, 9.7, 9.8

Module-5 Decidability and Complexity (8 hours)

Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, Halting problem of TM, Post correspondence problem.
Complexity: Growth rate of functions, Classes of P and NP, Polynomial Time Reduction and Np-Completeness, Quantum Computation: Quantum computers, Church-Turing thesis.
Textbook 2: Chapter 10: 10.1-10.6, Chapter 12: 12.1-12.3, 12.8(12.8.1, 12.8.2)

Course Outcomes: At the end of the course the student will be able to:	
21CSE503.1	Demonstrate an understanding of the core concepts in automata theory and theory of computation

21CSE503.2	Compare different models of computation and deduce optimum solutions for the problems.
21CSE503.3	Illustrate grammars and automata for different language classes by relating it for various applications
21CSE503.4	Classify a problem with respect to different models of computation.
21CSE503.5	Estimate the boundary between context-free and non-context free languages and solve non- context free language problems using formal models
21CSE503.6	Examine the decidable and undecidable problems, the complexity of the problem and Quantum Computation.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Automata, Computability and Complexity	Elaine Rich	Pearson Education Asia	1st Edition, 2019
2	Theory of Computer Science	K L P Mishra, N Chandrasekaran	PHI	3rd Edition, 2012
Reference Books				
1	Introduction to languages and the theory of computation	J Martin	Tata McGraw-Hill	3rd Edition, 2007
2	Elements and Theory of Computation	C Papadimitrou and C. L. Lewis	PHI	3rd Edition, 2012
3	Mathematical Foundation of Computer Science	Y.N.Singh	New Age International	1st Edition, 2005
4	A Formal Languages and Automata Theory	C K Nagpal	Oxford University press	1st Edition, 2012

Web links and Video Lectures (e-Resources):

- **Theory of Computation & Automata Theory:** https://www.youtube.com/watch?v=58N2N7zJGrQ&list=PLBlnK6fEyqRgp46KUv4ZY69yXmpwKOIev
- **Automata Theory :** https://www.youtube.com/watch?v=wXMkeJyI7YE&list=PLm_MSClsnwm-gKA0hAZkIrPO-BlYAtiEV
- **Computer - Theory of Automata, Formal Languages and Computation :** https://www.youtube.com/watch?v=-aIRqNnUvEg&list=PL85CF9F4A047C7BF7
- **Introduction to Automata, Languages and Computation :** https://www.youtube.com/watch?v=_2w9UX17m_k&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM
- **Computer Science - Theory of Computation** : https://www.youtube.com/watch?v=al4AK6ruRek&list=PLbMVogVj5nJSd25WnSU144ZyGmsqjuKr3

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE503.1	3													1
21CSE503.2	3													1
21CSE503.3		2												1
21CSE503.4		2												1
21CSE503.5				2										1
21CSE503.6				2										1

1: Low 2: Medium 3: High

Big Data and Analytics			
Course Code	**21CSE504**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Explain the Hadoop framework and Hadoop Distributed File system
- Demonstrate MapReduce programming model to process the big data
- Illustrate the concepts of NoSQL using MongoDB for Big Data
- Analyze text mining, web mining and Social network system.

Module-1 Introduction to Big Data Analytics (8 hours)

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

Textbook 1: Chapter 1.2-1.5.3, 1.6, 1.7

Module-2 Introduction to Hadoop and HDFS (8 hours)

Introduction to Hadoop (T2): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn.

Hadoop Distributed File System Basics (T1): HDFS Design Features, Components, HDFS User Commands.

Essential Hadoop Tools (T1): Using Apache Sqoop, Flume, and Oozie

Textbook 1: Chapter 2.1-2.5

Textbook 2: Chapter 3, Chapter 7

Module-3 MapReduce, Hive and Pig (8 hours)

MapReduce, HBase and Spark: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms

Apache Hbase: Using Apache Hbase, HBase Data Model Overview, HBase Example Walk-Through

Apache Spark: A gentle Introduction to Spark: Basic architecture, Spark Language API, Starting Spark, Spark Session, DataFrames, Partitions, Transformations, Lazy Evaluation, Actions, Spark UI

Textbook 1: Chapter 4.1-4.6

Textbook 2: Chapter 7

Textbook 3: Chapter 2

Hands On:

1) Demonstrate MapReduce program in python to find occurrences of each word in a text file.
2) Write MapReduce program to demonstrate the use of Aggregate functions on suitable products.
3) Demonstrate MapReduce program on Addition and Subtraction of two Matrices.
4) Demonstrate Problems on Apache Spark

Module-4 NoSQL and MongoDB database (8 hours)

NoSQL data store and MongoDB database: Introduction, NoSQL Data store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB Database.

Textbook 1: Chapter 3.1-3.6

Hands On:

1) Create the Database and implement Insert, Delete and Search functions using MongoDB query language.

Module-5 Social Network Analytics (8 hours)
Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics. Page Rank, Structure of Web and analyzing Web Graph. Social Network as Graphs and Social Network Analytics. **Textbook 1: Chapter 9.1-9.5**

Course Outcomes: At the end of the course the student will be able to:	
21CSE504.1	Interpret fundamentals of Big Data analytical and application systems.
21CSE504.2	Illustrate the concept of Hadoop framework, HDFS and tool services.
21CSE504.3	Demonstrate MapReduce programming model to process Big Data.
21CSE504.4	Interpret Essential Hadoop tools to process Big Data.
21CSE504.5	Illustrate the concepts of NoSQL using MongoDB for Big Data storage.
21CSE504.6	Analyze the text content, web content and Social Network Analytics for effective analytics.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning	Raj Kamal and Preeti Saxena	McGraw Hill Education	1st Edition, 2018
2	Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem	Douglas Eadline	Pearson Education	1st Edition, 2016
3	Spark The Definitive guide, Big Data processing made simple	Bill Chambers & Matei Zaharia	O'Reilly	1st Edition, 2018
Reference Books				
1	Big Data and Hadoop	V.K. Jain	Khanna Book Publishing	1st Edition, 2017
2	Data Analytics	Maheshwari	McGraw	1st Edition, 2017
4	Big Data Analytics: A Hands-On Approach	Arshdeep Bahga, Vijay Madisetti	VPT Publications	1st Edition, 2018
3	Big Data Analytics	Seema Acharya	Wiley	2nd Edition, 2019

Web links and Video Lectures (e-Resources):

- **Fundamentals of Big Data:** https://www.simplilearn.com/what-is-big-data-analytics-article
- **Introduction to Hadoop:** https://www.geeksforgeeks.org/hadoop-an-introduction/
- **View of MapReduce concepts:** https://www.guru99.com/introduction-to-mapreduce.html
- **Essential Hadoop Tools:** https://www.educba.com/hadoop-tools/
- **Analytics of Social Media using Big Data:** https://www.ibm.com/in-en/topics/social-media-analytics

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE504.1	1	1	1	1				1					1	1
21CSE504.2			1	3	2								1	2
21CSE504.3		1		2						1	1	1	2	1
21CSE504.4		1		2	2					1		1	2	1
21CSE504.5		1		1	1								1	1
21CSE504.6			1		1									2

1: Low 2: Medium 3: High

Artificial Intelligence and Machine Learning			
Course Code	**21CSE505**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40	Credits	03

Course Learning Objectives: The objective of the course is to

- Introduce the concepts of Artificial Intelligence.
- Understand the importance of Artificial Intelligence in problem-solving.
- Analyze various learning algorithms using machine learning.
- Apply the knowledge of Bayesian learning and Unsupervised learning.
- Develop the knowledge of Reinforcement learning and Q-learning.

Module-1 Artificial Intelligence in Problem Solving (8 hours)

Introduction to Artificial Intelligence: AI Problems, Assumptions, AI techniques.
Problems, Problem spaces and search: Defining the problem as a State Space Search, Production Systems, Problem Characteristics.
Heuristic search techniques: Generate and Test, Best-first Search, Problem Reduction.
Textbook 2: Chapter 1 (1.1 - 1.3), Chapter 2, Chapter 3 (3.1, 3.3-3.4)

Module-2 Machine Learning and Supervised Learning (8 hours)

Introduction to Machine Learning: Introduction, Data Representation, Forms of Learning.
Supervised Learning Rationale and Basics: Learning from Observations, Heuristic search in Inductive Learning, Estimating Generalization Errors, Metrics for Assessing Regression, Metrics for Assessing Classification, Overview of the Design Cycle and Issues in Machine Learning.
Decision Tree Learning: Introduction, Decision Tree representation, Appropriate problems, ID3 Algorithm.
Textbook 1: Chapter 1 (1.1-1.7), Chapter 2, Chapter 8 (8.1-8.6)

Module-3 Statistical Learning (8 hours)

Statistical Learning: Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in Learning Techniques, Bayesian Reasoning: A Probabilistic Approach to Inference, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Minimum Description Length Principle.
Textbook 1: Chapter 3 (3.1-3.3, 3.6,3.7, 3.9)

Module-4 Learning with Neural Networks and Unsupervised Learning (8 hours)

Learning with Support Vector Machines: Introduction, Non-Linear Classification, Regression by Support Vector Machines.
Learning with Neural Networks: Towards Cognitive Machine, Neuron models, Perceptions, The Error-Correction Delta rule, Multi-Layer Perceptron (MLP) Networks and the Error-Backpropagation Algorithm, Multi-Class Discrimination with MLP Networks.
Data Clustering and Data Transformations: Unsupervised learning, Engineering the Data, Overview of Basic Clustering Methods, EM Algorithm, K-Means Clustering, Fuzzy K-Means Clustering, Expectation-Maximization (EM) Algorithm and Gaussian Mixtures Clustering.
Textbook 1: Chapter 4 (4.1-4.5), Chapter 5 (5.1, 5.2, 5.4, 5.6-5.8), Chapter 7 (7.1-7.6)

Module-5 Genetic Algorithm and Reinforcement Learning (8 hours)

Genetic Algorithm (GA) For Search Optimization: Overview, The Basic Genetic Algorithm
Reinforcement Learning: Introduction, Elements of Reinforcement Learning, Basics of Dynamic Programming, Temporal Difference Learning.
Textbook 1: Appendix A, B

Course Outcomes: At the end of the course the student will be able to:	
21CSE505.1	Apply the knowledge of Artificial intelligence in problem solving
21CSE505.2	Analyze Machine learning algorithms using statistical metrics.
21CSE505.3	Apply the concepts of Artificial Neural Networks and Bayesian Learning.
21CSE505.4	Classify the data points using Supervised machine learning algorithms and apply them for prediction task.
21CSE505.5	Analyze Bayesian learning algorithms and Unsupervised learning algorithms.
21CSE505.6	Apply Reinforcement learning and Q-learning to find the best course of action given the current state.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Applied Machine Learning	M. Gopal	McGraw Hill	1st Edition, 2019
2	Artificial Intelligence	Elaine Rich, Kevin K and S B Nair	McGraw Hill	3rd Edition, 2017
Reference Books				
1	Artificial Intelligence	Saroj Kaushik	Cengage learning	1st Edition, 2011
2	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson Education	3rd Edition, 2010
3	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd Edition, 2008

Web links and Video Lectures (e-Resources):

- **NPTEL course on Fundamentals Of Artificial Intelligence**: https://nptel.ac.in/courses/112103280
- **Resources course on Artificial Intelligence**: https://cse.iitk.ac.in/users/cs365/2015/resources.html
- **NPTEL course on Machine Learning**: https://onlinecourses.nptel.ac.in/noc22_cs24/preview
- **NPTEL course on Introduction to Machine Learning**: https://onlinecourses.nptel.ac.in/noc22_cs29/ preview

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE505.1	3													1
21CSE505.2		2												1
21CSE505.3	3													1
21CSE505.4		2												1
21CSE505.5					2									1
21CSE505.6					2									1

1: Low 2: Medium 3: High

Artificial Intelligence and Machine Learning Laboratory			
Course Code	**21CSL506**	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 Hours
Total Hours	20	Credits	01

Course Learning Objectives: The objective of the course is to

- Analyze various Search techniques using heuristic approaches.
- Analyze supervised machine learning models and apply them for Classification task.
- Apply the knowledge of Regression using various regression algorithms.
- Develop the knowledge of problem solving and apply them to solve classical problems in AI.

Note: Implement and evaluate AI and ML algorithms in Python programming language

Experiments (8 hours)

A–Demonstration (offline/virtual):

A1. Searching using Depth first search and Breadth first search.
A2. Data Preprocessing for developing machine learning models.
A3. Classification of data points using Logistic regression.
A4. Prediction using Linear Regression.
A5. Implementation of Multilayer perceptron for classification.

B–Exercise (compulsorily to be conducted):

B1. Implement A* Search algorithm.
B2. Implement Best first search algorithm.
B3. Write a program to demonstrate the working of the Decision tree based ID3 algorithm. Use an appropriate data set for building the Decision tree and apply this knowledge to classify a new sample. Do not use Python ML library APIs for this problem.
B4. Implement the Non-parametric Locally Weighted Regression Algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

C–Structured Enquiry (compulsorily any 4 to be conducted):

C1. Implement AO* Search algorithm.
C2. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
C3. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
C4. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for Clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can use Python ML library classes/API in the program.
C5. Write a program to implement k-Nearest Neighbour algorithm to classify the Iris data set. Print both the correct and wrong predictions. You can use Python ML library classes/API in the program.

D–Open Ended Experiments (any two):

D1. Implement Classification problem using Random Forest Algorithm.
D2. Write a program to implement Regression using Support vector Regression.
D3. Write a program to implement the Water jug Problem
D4. Write a program to implement Tower of Hanoi Problem.

Course Outcomes: At the end of the course the student will be able to:	
21CSL506.1	Analyze various Search techniques using heuristic approach.
21CSL506.2	Apply problem solving techniques to solve classical AI problems.

21CSL506.3	Utilize the Back propagation algorithm to analyze the working of artificial neural networks.
21CSL506.4	Build machine learning classification models for solving real world problems.
21CSL506.5	Evaluate the Clustering algorithms on the performance metrics.
21CSL506.6	Construct Regression models for solving various prediction tasks.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Applied Machine Learning	M. Gopal	McGraw Hill	1st Edition, 2019
2	Artificial Intelligence	Elaine Rich, Kevin K and S B Nair	McGraw Hill	3rd Edition, 2017
Reference Books				
1	Artificial Intelligence	Saroj Kaushik	Cengage learning	1st Edition, 2011
2	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson Education	3nd Edition, 2010
3	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd Edition, 2008

Web links and Video Lectures (e-Resources):

- **NPTEL course on Fundamentals Of Artificial Intelligence:** https://nptel.ac.in/courses/112103280
- **Resources on Artificial Intelligence:** https://cse.iitk.ac.in/users/cs365/2015/resources.html
- **NPTEL course on Machine Learning:** https://onlinecourses.nptel.ac.in/noc22_cs24/preview
- **NPTEL course on Introduction to Machine Learning:** https://onlinecourses.nptel.ac.in/noc22_cs29/ preview

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSL506.1	3													1
21CSL506.2		2												1
21CSL506.3	3													1
21CSL506.4		2												1
21CSL506.5				2										1
21CSL506.6				2										1

1: Low 2: Medium 3: High

Research Methodology and Intellectual Property Rights			
Course Code	**21RMI507**	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:

1. To understand the basic concepts related to research
2. To learn the concept of literature survey, review and technical writing
3. To discuss the basics of intellectual property
4. To explain the patents, copyrights, trademarks, industrial designs and geographical indications

Module-1 Research Methodology and Literature Survey (8 hours)

Research Methodology: Meaning, objectives, types, significance of research. Research approaches, method versus methodology, research process, Criteria of good research. Defining the research problem: conditions, components, selection, necessity, techniques and illustrations.

Literature Survey, Literature Review: Introduction, process, databases (Google Scholar, Web of Science, Scopus, Science Direct etc) and management tools. Author Metrics and Journal Metrics, Identifying gap areas from literature review. Ethics in research and publications. Plagiarism: Introduction, tools for detection, avoiding plagiarism. Illustrations.
Textbook 1: Ch 1 and 2, Textbook 2: Ch 7-17.

Module-2 Technical Writing and Presentations (8 hours)

Research Paper Writing: Importance, steps of writing research papers, Contents of a research article, referencing and citations, submission and post-submission. Illustrations.

Thesis Writing: Synopsis, Introduction, Literature review, Aim and objectives, Methodology, Time frame, Results and discussions, Conclusions.
Research Proposal Writing: Types of research projects, Major funding agencies in India, Preliminary requirements for proposal writing, Standard heads in research proposal. Illustrations.
Textbook 2: Ch 20-28, 35.

Module-3 Introduction to IPR and Patents (8 hours)

Introduction to Intellectual Property: Meaning, relevance, Types of IP, Role of International Institutions: The Patent Cooperation Treaty (PCT), TRIPS Agreement, WIPO, IP system in India and National IPR Policy in India.

Patents: Concept, Patents Act 1970 and its amendments, Patentable Subject Matter and Patentability Criteria, Non- Patentable Subject Matter, Procedure for Filing of Patent Application and types of Applications, Patent Search and Databases, Patent Granting Procedure, Rights of Patentee, Patent Infringement, Recent Developments: Patenting of Softwares, Inventions in Biotechnology. Illustrations.
Textbook 3: Lesson 1-10

Module-4 Copyright and Trademarks (8 hours)

Copyright: Introduction, meaning, nature of copyright protection, Indian copyright law: Classes of work, copyright pertaining to software, Authorship and ownership and rights, Terms of copyright, Assignment, transmission and licensing, Infringement of copyrights: Exceptions and remedies, Copyright societies, Office, board, Registration of copyrights and appeals, Illustrations.

Trademark: Introduction, The Trade Marks Act 1999, Important Definitions, Trade Mark Rules 2017, Procedure of registration of trade mark in India. Duration and renewal, Opposition to registration, Grounds for refusal to registration, Rights conferred by registration, Infringement of registered Trade Mark and Remedies. Illustrations.

Textbook 3: Lesson 11 and 12.

Module-5 Industrial Designs and Geographical Indications (8 hours)
Industrial Designs: Introduction, Need for protection of industrial designs, Registrable and non-registrable designs, Registration of designs, Infringement of Industrial Designs–and Remedies, Illustrations. **Geographical Indications (GIs):** Introduction, Geographical Indications of Goods (Registration & Protection) Act, 1999, Procedure for registration of geographical indications, Infringement of GIs. **Layout – Designs of Integrated Circuits:** Introduction, Procedure for Registration of Layout design under the Semi-Conductor Integrated Circuits Layout-Design Act, 2000, Conditions and Procedures for registration. Infringement and Penalty. **Miscellaneous Topics:** The Protection of Plant Varieties and Farmers' Rights, Protection of Traditional Knowledge and Bio-diversity Act. Textbook 3: Lesson 13-16, Textbook 4: Ch 70.

Course Outcomes: At the end of the course the student will be able :	
21RMI507.1	To conduct literature survey, review and define a research problem.
21RMI507.2	To follow research ethics and develop the art of writing technical papers and reports.
21RMI507.3	To discuss the importance of Intellectual Property Rights in India.
21RMI507.4	To explain the various forms of Intellectual Property and its relevance in Indian context.
21RMI507.5	To explain the legal aspects of patents, copyrights and trademarks in India.
21RMI507.6	To explain the legal aspects of industrial designs, geographical indications and semi-conductor integrated circuits layout-designs in India.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Research Methodology: Methods and Techniques	C R Kothari and Gaurav Garg	New Age International Publishers	4th Edition 2019
2	Academic Writing	Ajay Semalty	B S Publications	2021
3	Intellectual Property Rights – Laws and Practice	The Institute of Company Secretaries of India, New Delhi	Delhi Computer Services, New Delhi	2018
4	Law Relating to Intellectual Property Rights	V K Ahuja	LexisNexis, India	3rd Edition 2017
Reference Books				
1	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	Sage Publications India Pvt Ld New Delhi	4th Edition 2014
2	Intellectual Property: A Primer for Academia	Prof. Rupinder Tewari and Ms. Mamta Bhardwaj	Publication Bureau, Panjab University, India	2021
Additional Resources: Web links/NPTEL Courses https://ipindia.gov.in/ (Official website of Intellectual Property India) https://dpiit.gov.in/policies-rules-and-acts/policies/national-ipr-policy https://www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf https://corpbiz.io/learning/design-infringement-in-india/				

https://nptel.ac.in/courses/121106007 (Introduction to Research (Research Methodology))
https://nptel.ac.in/courses/109105112 (Introduction on Intellectual Property to Engineers and Technologists)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21RMI507.1	-	**2**	-	-	**1**	-	-	-	-	-	-	**2**	-	-
21RMI507.2	-	-	-	-	**1**	-	-	**3**	-	**2**	-	-	-	-
21RMI507.3	-	-	-	-	-	**2**	-	-	-	**2**	-	-	-	-
21RMI507.4	-	-	-	-	-	**2**	-	-	-	**2**	-	-	-	-
21RMI507.5	-	-	-	-	-	**2**	-	-	-	**2**	-	-	-	-
21RMI507.6	-	-	-	-	-	**2**	-	-	-	**2**	-	-	-	-

1: Low 2: Medium 3: High

Emerging Technologies: A Primer			
Course Code	21ETP509	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	0	Exam Hours	02

Course Learning Objectives:

1. To develop a strong awareness of the ethical and societal implications associated with emerging technologies.
2. To instil practical skills related to AI (Artificial Intelligence), Blockchain, Digital Twins, RPA (Robotic Process Automation), and Cybersecurity.
3. To enable experiences of working on a team project, allowing students to apply their knowledge and skills to a real-world problem and present their findings effectively.

Module-1: AI and Web 3.0 (06 Hours)

Introduction to Emerging Technologies: Overview of the course, Importance of staying updated with emerging technologies, Ethical and societal considerations.

Artificial Intelligence (AI): Definition and history of AI, Machine learning and deep learning, Applications of AI in various industries, In-Class Assignment: AI in Everyday Life, Homework Assignment: Building a Simple Chatbot.

Web 3.0: Blockchain and Metaverse - Introduction to Blockchain technology, Metaverse and its potential, In-Class Assignment: Creating a Simple Smart Contract, Homework Assignment: Exploring a Metaverse Platform.

Module-2: Smart Manufacturing and Robotic Process Automation (06 Hours)

Smart Manufacturing and Digital Twins: The concept of Smart Manufacturing, Role of IoT and sensors, Digital Twins and their applications, In-Class Assignment: Explore the designs of Digital Twins, Homework Assignment: Analysing a Smart Manufacturing Case Study.

Robotic Process Automation: Understanding Robotic Process Automation (RPA), Types of robots and their applications, Human-robot collaboration, In-Class Assignment: Automating a Task with RPA, Homework Assignment: Researching Advances in Robotics.

Module-3: Cybersecurity and Quantum Computing (06 Hours)

Cybersecurity: Importance of cybersecurity in the digital age, Threats and vulnerabilities, Security best practices, In-Class Assignment: Ethical Hacking Simulation, Homework Assignment: Creating a Cybersecurity Plan.

Quantum Computing: Introduction to Quantum Mechanics, Quantum bits (qubits) and quantum gates, Quantum supremacy and real-world applications. Homework Assignment: Exploring Quantum Computing Research.

Module-4: Project Work (06 Hours)

Team Formation, Synopsis submission, Mid-Term Progress Review, Final Project Presentation.

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

21ETP509.1	Assess the ethical and societal impacts of emerging technologies, demonstrating critical thinking skills.
21ETP509.2	Apply AI and Web 3.0 concepts to develop practical solutions and explore real-world applications.
21ETP509.3	Apply RPA principles and tools to automate common tasks to boost productivity.
21ETP509.4	Explain common cybersecurity threats and recommend best practices to safeguard digital assets.
21ETP509.5	Explain the fundamentals of quantum computing and its real-world applications.
21ETP509.6	Develop a solution using emerging technologies for a real-world problem in teams.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson	Fourth Edition, 2020
2	Blockchain Technology	Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan	Universities Press (India) Pvt. Ltd.	First Edition 2020
3	Metaverse and Web 3: A Beginner's Guide: A Beginner's Guide: A Digital Space Powered with Decentralized Technology	Utpal Chakraborty	BPB Publications	First Edition, 2022
4	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath	Alok Mani Tripathi	Packt Publishing	First Edition 2018
5	Cybersecurity: The Beginner's Guide: A comprehensive guide to getting started in cybersecurity	Dr. Erdal Ozkaya	Packt Publishing Limited	First Edition 2019
6	Quantum Computing: A Gentle Introduction	Eleanor G. Rieffel, Wolfgang H. Polak.	MIT Press	First Edition 2014
Reference Books				
1	Smart Manufacturing Technologies for Industry 4.0: Integration, Benefits, and Operational Activities	Edited By: Jayakrishna Kandasamy, Kamalakanta Muduli, V. P. Kommula, Purushottam L. Meena	CRC Press	First Edition 2022
2	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems	Tom Taulli	Apress Berkeley, CA	2020
3	The Cyber Security Handbook: Prepare for, respond to and recover from cyber-attacks with the IT Governance Cyber Resilience Framework (CRF)	Alan Calder	IT Governance Publishing	First Edition 2020

Web links/Video Lectures:

Introduction to Emerging Technologies:

1. https://aiethics.princeton.edu/case-studies/case-study-pdfs/
2. https://research.aimultiple.com/ai-ethics/
3. https://news.harvard.edu/gazette/story/2020/10/ethical-concerns-mount-as-ai-takes-bigger-decision-making-role/
4. https://www.sciencedirect.com/science/article/pii/S0268401223000816
5. https://www.youtube.com/watch?v=G2fqAlgmoPo
6. https://www.youtube.com/watch?v=zizonToFXDs

Web 3.0: Blockchain and Metaverse

1. What is Ethereum? | ethereum.org
2. Navigating Remix — Remix - Ethereum IDE 1 documentation (remix-ide.readthedocs.io)
3. Solidity — Solidity 0.6.8 documentation (soliditylang.org)

4. https://www.youtube.com/watch?v=nalMdCI_pv8&t=765s
5. The Decentralized Autonomous Organization and Governance Issues by Usman W. Chohan :: SSRN
6. Ethereum Smart Contract Best Practices (consensys.github.io)
7. https://hackernoon.com/hack-solidity-reentrancy-attack

Smart Manufacturing and Digital Twins:

1. https://www.youtube.com/watch?v=nwFed03fS_s
2. https://www.youtube.com/watch?v=ScmK-bKJ4MI

RPA and Robotics:

1. https://www.youtube.com/watch?v=9URSbTOE4YI
2. https://www.youtube.com/watch?v=UEbw7dIOg0g
3. https://www.uipath.com/resources/automation-case-studies
4. https://www.ibm.com/products/robotic-process-automation/case-studies

Cybersecurity:

1. https://www.getastra.com/blog/security-audit/what-is-vapt/
2. https://owasp.org/www-project-top-ten/
3. https://owasp.org/www-project-mutillidae-ii/
4. https://www.youtube.com/watch?v=JAtwZoW76-I
5. Threat modelling (STRIDE framework): https://learn.microsoft.com/en-us/azure/security/develop/threat-modeling-tool-threats
6. Cyber Kill Chain:https://www.lockheedmartin.com/en-us/capabilities/cyber/cyber-kill-chain.html

Quantum Computing:

1. https://www.youtube.com/watch?v=e3fz3dqhN44
2. https://quantumai.google/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21ETP509.1	-	-	-	-		**3**	-	**2**	-	--	-	-
21ETP509.2	-	**2**	-	-	**3**	-	-	-		-	-	**1**
21ETP509.3	-	-	-	**3**	**2**	-	-	-	--	-	-	-
21ETP509.4	-	-	-	-	**3**	-		-	-	-	-	**1**
21ETP509.5	**2**	-	-	-	**3**	-	-	-	-	-	-	-
21ETP509.6	-	-	**2**	-	**3**	-	--	-	**2**	-	-	**1**

1: Low 2: Medium 3: High

VI Semester

System Software and Compiler Design			
Course Code	**21CSE601**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Analyze the working of system software.
- Identify source file, object file and executable file structures and libraries.
- Distinguish the front-end and back-end phases of the compiler and their importance.
- Develop the knowledge of implementing lexical analyzer and syntax analyzer

Module-1 System Software, Assemblers (8 hours)

Background: Introduction to System Software, Machine Architecture of SIC and SIC/XE.
Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features.
Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter 2: 2.1 to 2.3

Module-2 Compiler Design, Lexical analysis (8 hours)

Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building a compiler, Applications of compiler technology.
Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens.
Text book 2: Chapter 1: 1.1-1.5 Chapter 3: 3.1 – 3.4

Module-3 Syntax Analysis (8 hours)

Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers. **Text book 2: Chapter 4: 4.1, 4.2 4.3 4.4 4.5**

Module-4 Lex and Yacc (8 hours)

Lex and Yacc –The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand-Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program,
Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity.
Text book 3: Chapter 1,2 and 3

Module-5 Syntax Directed Translation, Intermediate code generation, Code generation (8 hours)

Syntax Directed Translation: Syntax directed definition, evaluation orders for SDD's, Applications of syntax directed Translation scheme.
Intermediate code generation: Variants of syntax trees, Three address code
Code generation : Issues in the design of a code generator, The target language
Text book 2: Chapter 5: 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2

PRACTICAL MODULE

A–Demonstration

A1. Demonstration of LEX program
A2. Demonstration of YACC program

B–Exercise (compulsorily to be conducted):

B1. Write a LEX program to recognize valid arithmetic expressions. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.

B2. Write a LEX program to eliminate comment lines in a C program and copy the resulting program into a separate file.
B3. Write a Lex program to count the number of words, lines, tabs and spaces used in the input.
B4. Write a Lex program to search for a word in a file.

C–Exercise (compulsorily - any 4 to be conducted):

C1. Write a YACC program to evaluate arithmetic expressions involving operators: +, -, *, and /.
C2. Write a YACC program to recognize valid identifiers, operators, and keywords in the given text (C program) file.
C3. Develop, Implement, and Execute a program using YACC tool to recognize all strings ending with b preceded by n a's using the grammar $a^n b$ (note: input n value)
C4. Design, develop and implement YACC/C program to construct Predictive / LL(1) Parsing Table for the grammar rules: A →aBa , B →bB | ε. Use this table to parse the sentence: abba$
C5. Design, develop and implement YACC/C program to demonstrate Shift Reduce Parsing technique for the grammar rules: E →E+T | T, T →T*F | F, F →(E) | id and parse the sentence: id + id * id.

D–Open Ended Experiments (any two):

D1. Using the appropriate tool (Lex/Yacc), write a program to recognize for statements of C.
D2. Using the appropriate tool (Lex/Yacc), write a program to recognize if-else statements of C.
D3. Using the appropriate tool (Lex/Yacc), write a program to recognize switch statements of C.
D4. Using the appropriate tool (Lex/Yacc), write a program to recognize while statements of C.

Course Outcomes: At the end of the course the student will be able to:	
21CSE601.1	Identify the steps involved in assembling SIC/XE assembly language programs.
21CSE601.2	Utilize and implement various techniques employed in designing and developing lexical analyzers.
21CSE601.3	Implement various techniques and algorithms employed in designing and developing parsers.
21CSE601.4	Utilize lex and yacc tools for implementing different concepts of system software.
21CSE601.5	Analyze the implementation aspects of a compiler using Syntax-Directed Translation
21CSE601.6	Examine the code generators and their functions.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	System Software	Leland. L. Beck, D Manjula	Pearson	3rd Edition, 2012
2	Compilers-Principles, Techniques and Tools	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	Pearson	2nd Edition, 2013
3	Lex & Yacc	Doug Brown, John Levine, Tony Mason,	O'Reilly Media	1st Edition, 2012
Reference Books				
1	Systems programming	Oxford university press	Oxford university press	1st Edition, 2016

2	Systems Programming and operating system	D. M. Dhamdhere	Tata MC Graw-Hill	2nd Edition, 1993
3	Compiler Design	K Muneeswaran	Oxford University Press	1st Edition, 2013

Web links and Video Lectures (e-Resources):

- **NPTEL Videos on Compiler Design**: https://archive.nptel.ac.in/courses/106/104/106104123/
- **NPTEL Video on System Programming:** https://www.youtube.com/watch?v=zj2VsRnji6c&list=PLM-jfaoaU5iy0Zq-NlWycsfzyMKrAV7jw
- **NPTEL Video on System Software:** https://www.youtube.com/watch?v=VG9VopzV_T0

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE601.1	1	1	1	1		2	2			1		1		1
21CSE601.2	2	1	1	1			1					1		2
21CSE601.3	2	1	1	2						1		1		2
21CSE601.4			1	1	2									
21CSE601.5		1	1	1						1		1		1
21CSE601.6	1	1	1				1							1

1: Low 2: Medium 3: High

Full Stack Development			
Course Code	**21CSE602**	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: The objective of the course is to

- Illustrate the Semantic Structure of HTML and CSS
- Design Client-Side programs using JavaScript
- Understand the basics of React and create components and lifecycle
- Build applications using React JSX and Node.js
- Design databases using MongoDB

Module-1 HTML and CSS (8 hours)

Introduction to HTML: What is HTML and Where did it come from? HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements.
Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.
Textbook 1: Chapter 2, 3

Module-2 JavaScript and React Basics (8 hours)

JavaScript: Client-Side Scripting: What is JavaScript and What can it do? JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms.
Hello World: Hello React World, What Just Happened? React.createElement(), JSX, Setup Babel.
The Life of a Component: A Custom Function Component, A Custom Class Component, Properties, State, A textarea Component, Make It Stateful.
Textbook 1: Chapter 6 and Textbook 2: Chapter 1, 2

Module-3 Advanced React (8 hours)

The Life of a Component: A Note on DOM Events, Props Versus State, Props in Initial State, Accessing the Component from the Outside, Lifecycle Methods, Lifecycle Example: Log It All, Lifecycle Example: Using a Child Component.
JSX: A Couple Tools, Whitespace in JSX, Comments in JSX, HTML Entities, Spread Attributes, Returning Multiple Nodes in JSX.
Textbook 2: Chapter 2, 5

Module-4 Node.js (8 hours)

Welcome to Node.js: Built on JavaScript, Asynchronous and evented, DIRTy applications, DIRTy by default.
Building a Multiroom Chat Application: Application overview, Application requirements and initial setup, Serving the application's HTML, CSS, and client-side JavaScript, Handling chat-related messaging using Socket.IO, Using client-side JavaScript for the application's user interface.
Textbook 3: Chapter 1, 2

Module-5 MongoDB and Databases (8 hours)

Getting Started: Documents, Collections, Databases, Starting MongoDB, Introduction to the MongoDB Shell, Data Types, Using the MongoDB Shell.
Creating, Updating, and
Deleting Documents: Inserting Documents, Removing Documents, Updating Documents.
Querying: Introduction to find, Query Criteria, Type-Specific Queries, $where Queries, Cursors.
Textbook 4: Chapter 2, 3, 4

Course Outcomes: At the end of the course the student will be able to:	
21CSE602.1	Apply HTML and CSS syntax and semantics to build web pages
21CSE602.2	Design Client-Side Scripts using JavaScript
21CSE602.3	Apply the concepts of React to create Components and design applications using the Lifecycle method
21CSE602.4	Build applications using React JSX
21CSE602.5	Develop applications using Node.js
21CSE602.6	Construct Databases using MongoDB

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar	Pearson Education India	1st Edition, 2015
2	React: Up & Running: Building Web Applications	Stoyan Stefanov	O'Reilly Media, Inc.	2nd Edition, 2021
3	Node.js in Action	Mike Cantelon, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich	Manning Publications	1st Edition, 2014
4	MongoDB: The Definitive Guide	Shannon Bradshaw, Eoin Brazil, Kristina Chodorow	O'Reilly Media, Inc.	3rd Edition, 2019
Reference Books				
1	Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5	Robin Nixon	O'Reilly Publications	4th Edition, 2015
2	Professional JavaScript for Web Developers	Nicholas C Zakas	Wrox/Wiley India	3rd Edition, 2012
3	Node.js Web Development	David Herron	Packt Publishing	4th Edition, 2018
4	Fullstack React: The Complete Guide to ReactJS and Friends	Anthony Accomazzo, Ari Lerner, Nate Murray, Clay Allsopp, David Gutman, Tyler McGinnis	Fullstack.io	1st Edition, 2017

Web links and Video Lectures (e-Resources):

- **HTML Tutorial For Beginners 2023:** https://www.youtube.com/watch?v=OUjU--gVylE
- **CSS Tutorial - Zero to Hero:** https://www.youtube.com/watch?v=1Rs2ND1ryYc
- **What Is ReactJS?:** https://www.youtube.com/watch?v=Y6aYx_KKM7A
- **React JS Full Course For Beginners 2020:** https://www.youtube.com/watch?v=CI2kX2EFhWc
- **What Is Node.js:** https://www.youtube.com/watch?v=8u1o-OmOeGQ
- **What is Node.js Exactly?:** https://www.youtube.com/watch?v=pU9Q6oiQNd0
- **Node.js:** https://nodejs.dev/en/learn/
- **What is MongoDB?:** https://www.youtube.com/watch?v=1VM6AvRgmfY

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE602.1			3										1	
21CSE602.2					2								1	
21CSE602.3					2				2					
21CSE602.4					2									
21CSE602.5									2					
21CSE602.6			2						1					

1: Low 2: Medium 3: High

Discrete Mathematical Structures			
Course Code	**21CSE6031**	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: The objective of the course is to

- Develop knowledge of fundamental principles of counting, relations and its applications.
- Apply propositional logic and predicates in knowledge representation.
- Appraise various discrete structures and its applications in computer science.
- Develop knowledge of fundamental of number theory and its applications in computer science

Module 1: Sets and Relations (8 hours)

Introduction to Set: Operations on sets, Laws of set theory, Principle of inclusion exclusion, The Pigeonhole principle, Soft Set Theory.
Textbook 1 & 2

Module 2: More about relations and Functions (8 hours)

Relations and its Properties: Properties of relations, Equivalence relations, Computer representation of Relations and Digraphs.
Functions. Definition, Types of functions, Composition of functions, Invertible function.
Textbook 1

Module 3: Partially Ordered Sets and Group theory (8 hours)

Order relations and Structures: Partially Ordered Sets, External elements of Partially ordered sets, Lattices, Introduction to Group theory, Semi groups, Groups and Abelian groups.
Textbook 1

Module 4: Fundamentals of Logic (8 hours)

Fundamentals of logic: Propositions and Logical Operations, Conditional Statements, The laws of logic, Logical implication-Rules of inference, Quantifiers
Textbook 1

Module 5: Fundamental Principles of Counting (8 hours)

Fundamental Principles of Counting: Method of mathematical induction, The Rule of Sum and Product, Permutations, Combinations, The Binomial Theorem.
Textbook 1

Course Outcomes: At the end of the course the student will be able to:	
21CSE6031.1	Apply set theory in computer science applications.
21CSE6031.2	Recognize use of relations and its variants in Computer Science applications.
21CSE6031.3	Develop the knowledge of functions and its applications.
21CSE6031.4	Apply knowledge of group theory in computer science.
21CSE6031.5	Apply knowledge of propositional logic in computer science.
21CSE6031.6	Develop knowledge of principles of counting and its use in computer science.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	Pearson Education	5th Edition 2004
2	Soft Set Theory	P K Maji, R Biswas, A R Roy	Elsvier	2003. (Journal Article)
Reference Books				
1	Discrete Mathematical Structures with Applications to Computer Science	J.P. Tremblay and R. Manohar,	Tata McGraw-Hill	1st Edition 2017
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	TataMcGraw-Hill.	7th Edition 2017
2	Discrete Mathematical Structures	Bernard Kolman, Robert C. Busby, Sharon Ross	PHI	3rd Edition, 2001

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=xlUFkMKSB3Y&t=64s
- https://www.youtube.com/watch?v=3y6kXA9YEpA
- https://www.youtube.com/watch?v=nKsC70MtzkY
- https://www.youtube.com/watch?v=rSfEF9gaFGc

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE6031.1	2		2		2									2
21CSE6031.2			2										2	
21CSE6031.3	2					2								2
21CSE6031.4	2					2							2	2
21CSE6031.5	2		2											2
21CSE6031.6			2		2						2			

1: Low 2: Medium 3: High

DEEP LEARNING			
Course Code	**21CSE6032**	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: The objective of the course is to

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

Module-1 Introduction to Neural Networks (8 hours)

Introduction to Neural Networks (NN): Introduction, The Basic Architecture of NN, Multilayer NN, Training a NN with Backpropagation, Practical Issues in NN Training, Common Neural Architectures, Notable Benchmarks, **Shallow NN**: Neural Architectures for Binary Classification, Multiclass Models, Matrix Factorization with Autoencoders, Word2vec: An Application of Simple Neural Architectures

Textbook 1: Chapter 1: 1.1-1.4, 1.6, 1.8, Chapter 2: 2.1, 2.2, 2.3.1, 2.5.1-2.5.4, 2.6.1-2.6.2.

Module-2 Deep Neural Networks (8 hours)

Training Deep Neural Networks: Introduction, Setup and Initialization Issues, The Vanishing and Exploding Gradient Problems, Gradient-Descent Strategies, Practical Tricks for Acceleration and Compression, **Teaching Deep Learners to Generalize:** Introduction, The Bias-Variance Trade-Off, Generalization Issues in Model Tuning and Evaluation

Textbook 1: Chapter 3: 3.1, 3.3, 3.4, 3.5.1-3.5.3, 3.7, Chapter 4: 4.1-4.3, 4.5, 4.6

Module-3 Convolutional Neural Networks (8 hours)

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

Textbook 1: Chapter 8: 8.1-8.6

Module-4 Recurrent Neural Networks (8 hours)

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

Textbook 1: Chapter 7: 7.1-7.3, 7.5-7.7

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

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

Textbook 1: Chapter 10: 10.1-10.6

Course Outcomes: At the end of the course the student will be able to:	
21CSE6032.1	Inspect the different architectures of neural networks.
21CSE6032.2	Experiment with different parameters for training and generalizing deep neural networks.
21CSE6032.3	Design a convolutional neural network based solution to computer vision problems.
21CSE6032.4	Construct recurrent neural network for sequence data.
21CSE6032.5	Discover advanced methods of deep learning to address complex problems.
21CSE6032.6	Appraise the practical approach using a deep neural network to solve real-world problems.

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

Web links and Video Lectures (e-Resources):

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

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE6032.1	2	1			1						1	1	1	2
21CSE6032.2	1	1	1		2	1			2			3	1	2
21CSE6032.3	2	2	2	2	1	1	1	2		2	2	3	2	3
21CSE6032.4	2	1	3		2			1	1		2	2	1	2
21CSE6032.5	3	1	1	1	3		1	1	1	1	3	2		3
21CSE6032.6	2	2			1				3		1	1		1

1: Low 2: Medium 3: High

Blockchain Technology			
Course Code	**21CSE6033**	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: The objective of the course is to

- Outline the basics of Blockchain Technology.
- Explain the foundations of bitcoins.
- Appraise the idea of Ethereum Blockchain and Smart Contract.
- Explore Solidity Programming language to develop smart contract.
- Illustrate Hyperledger fabric and its framework.

Module-1 Introduction to Blockchain Technology (8 hours)

Introduction: Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Decentralization: Decentralization using Blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

Textbook 1: Ch 1, Ch 2

Module-2 Introduction to Bitcoins (8 hours)

Introducing Bitcoins: Bitcoin definition, Digital keys and addresses: Private keys in Bitcoin, Public keys in Bitcoin, Addresses in Bitcoin, Transactions: Transaction life cycle, Transaction data structure, Types of transaction, transaction verification. Blockchain: structure of a block, structure of block header, genesis block. Mining: Task of miners, mining rewards, Proof of work, mining algorithm, hash rate, mining systems, mining pools.

Bitcoin Network and Payments: The bitcoin network, wallets: Non deterministic wallets, deterministic wallet, Hierarchical deterministic wallet, brain wallet, paper wallet, hardware wallet, online wallet, mobile wallet. Bitcoin payments, Innovation in Bitcoin: Bitcoin Improvement Proposals, advanced protocols, segregated witness, bitcoin cash, bitcoin unlimited, bitcoin gold, bitcoin investment- buying and selling bitcoins.

Textbook 1: Ch 5, Ch 6

Module-3 Smart Contracts and Ethereum (8 hours)

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian Contracts. Ethereum 101: Introduction, Ethereum blockchain.

Further Ethereum: Blocks and Blockchain, The genesis block, block validation mechanisms, Block difficulty, Gas Fee schedule, Forks in blockchain, Nodes and miners, The consensus mechanism, CPU mining, GPU mining, Benchmarking, mining rigs, mining pools.

Textbook 1: Ch 10, Ch 11

Module-4 Introduction to Solidity (8 hours)

Introducing Solidity: Types, Value types: Boolean, Integers, Address, Array value types (fixed size and dynamically sized byte arrays), Literals, Integer literals, String literals, Hexadecimal literals, Enums, Function types, Internal functions, External functions, Reference types, Arrays, Structs, Data location, Mappings, Global variables, Control structures, Events, Inheritance, Libraries, Functions, Layout of a solidity source code file. Truffle Basics and Unit Testing, Debugging Contracts Remix IDE: Programs execution.

Textbook 1: Ch 13

Module-5 Hyperledger Fabric (8 hours)
Exploring Hyperledger Fabric: Building on the foundations of open computing, Fundamentals of the Hyperledger project, The Linux Foundation, Hyperledger, Open source and open standards, Hyperledger frameworks, tools, and building blocks, Hyperledger Fabric component design, Principles of Hyperledger design, Hyperledger Fabric reference architecture, Hyperledger Fabric runtime architecture, Strengths and advantages of componentized design. **Textbook 2:** Ch 2

Course Outcomes: At the end of the course the student will be able to:	
21CSE6033.1	Explain the fundamental building blocks of Blockchain technology.
21CSE6033.2	Outline the basics of Bitcoin, bitcoin network and payments.
21CSE6033.3	Appraise the concepts of smart contract and basics of Ethereum.
21CSE6033.4	Develop block chain-based solutions and write smart contract using Solidity
21CSE6033.5	Illustrate Hyperledger fabric and its framework, design principles and architecture
21CSE6033.6	Analyse the principles of Hyperledger design.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained	Imran Bashir	Packt Publishing	1st Edition, 2017
2	Block Chain with Hyperledger Fabric: Building Decentralized Applications using Hyperledger Fabric 2	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna	Packt Publishing	2nd Edition 2020
Reference Books				
1	Block Chain: Blueprint for a New Economy	Melanic Swan	O'Reilly	1st Edition 2015
2	Block Chain Basics	Daniel Drescher	Apress	1st Edition, 2017

Web links and Video Lectures (e-Resources):

- https://www.simplilearn.com/learn-blockchain-basics-skillup
- https://www.youtube.com/watch?v=0UvVOMZqpEA
- https://www.slideshare.net/Mithileysh/blockchain-technology-181440314
- https://intellipaat.com/blog/what-is-blockchain-technology/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE6033.1	3		2			3							3	
21CSE6033.2	3		2										3	
21CSE6033.3	2		2			3	3						3	
21CSE6033.4	2		3		3	2						3	3	
21CSE6033.5	2		2		2								3	
21CSE6033.6	2		2		2								3	

1: Low 2: Medium 3: High

Agile Technology			
Course Code	**21CSE6034**	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: The objective of the course is to

- Illustrate fundamental principles of Agile approaches
- Understand Scrum principles and associated terminologies.
- Adopt Lean thinking and eliminate waste.

Module-1 Learning Agile (8 hours)

Learning Agile: What is Agile? Getting Agile into Your Brain **Understanding Agile Values:** No Silver Bullet, Agile to the Rescue. A Fractured Perspective. The Agile Manifesto, Purpose Behind Each Practice. Understanding the Elephant, Where to Start with a New Methodology.
Textbook 1: Chapter 1, Chapter 2

Module-2 The Agile Principles (8 hours)

The Agile Principles: 12 principles of agile software, The customer is always right..right?, Delivering the project, Communicating and working together, Project execution, constantly improving project and team, The agile project: Bringing all principles together.
Textbook 1: Chapter 3

Module-3 Scrum and Self-Organizing Teams (8 hours)

Scrum and Self-Organizing Teams: The rules of Scrum, Act I: I can Haz Scrum?, Everyone on the scrum team owns the project, Act II: status updates are for social networks! The whole team uses the daily scrum, Act III: Sprinting into a wall-sprints, planning and retrospectives, Act IV: Dog catches car.
Textbook 1: Chapter 4

Module-4 Scrum planning and collective commitment (8 hours)

Scrum planning and collective commitment: Act V: Not quite expecting the unexpected, user stories, velocity and generally accepted scrum practices. Act VI: Victory Lap- scrum values revisited.
Textbook 1: Chapter 5

Module-5 Lean, Eliminating, and Seeing the Whole (8 hours)

Lean, Eliminating, and Seeing the Whole: Lean Thinking, Act I: Creating heroes and Magical thinking, Eliminating waste, Gain a deeper understanding of the product, Deliver as fast as possible. **Kanban, Flow, and Constantly Improving:** Principles of Kanban, Improving your process with Kanban, Measure and Managing Flow, Emergent behavior with kanban.
Textbook 1: Chapter 8, Chapter 9

Course Outcomes: At the end of the course the student will be able to:	
21CSE6034.1	Discover the purpose of agile practices and agile manifesto.
21CSE6034.2	Elaborate on principles of agile software development.
21CSE6034.3	Assess Scrum and team behaviors for achieving the project outcome.
21CSE6034.4	Appraise the role of planning and team behaviors in generally accepted scrum practices.

21CSE6034.5	Adapt lean thinking and eliminating waste in the project.
21CSE6034.6	Apply kanban to agile project management techniques

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Learning Agile	Andrew Stellman, Jill Alison Hart	O'Reilly	1st Edition, 2015
Reference Books				
1	Essential Scrum : A practical guide to the most popular Agile process	Rubin K.	Addison-Wesley	2nd Edition, 2013

Web links and Video Lectures (e-Resources):

- **Scrum guide:** https://www.scrum.org/resources/scrum-guide
- **Agile project management:** https://www.coursera.org/learn/agile-project-management

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE6034.1				3										3
21CSE6034.2									2					3
21CSE6034.3							2				3			
21CSE6034.4							2				3			
21CSE6034.5											3			
21CSE6034.6					3									3

1: Low 2: Medium 3: High

Introduction to Database Management System			
Course Code	**21CSE6041**	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: The objective of the course is to

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems.

Module-1 Databases and Database languages (8 hours)

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages.

The Basic(Flat) Relational Model: Relational Model Concepts, Characteristics of Relations, Insert Operation, Delete Operation, Update Operation

Textbook 1:Chapter 1.1 to 1.6, Chapter 2.1 to 2.3, Chapter 3.1 to 3.3

Module-2 Data Modelling and SQL (8 hours)

Conceptual Data Modeling Using Entities and Relationships : Introduction to high level conceptual data models, Sample database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types,Sets,Roles and Structural Constraints, Weak entity Types,ER Design, ER Diagrams and naming conventions.

SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Textbook 1:Chapter 7.1 to 7.7,Chapter 4.1 to 4.5

Module-3 Advances Queries and Database Application (8 hours)

SQL, Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views (Virtual Tables) in SQL, Schema change statements in SQL.

Textbook 1:Chapter 5.1 to 5.4 , Chapter 24.1

Module-4 Normalization (8 hours)

Normalization: Database Design Theory: Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, first Normal Form, Second Normal Form and Third Normal Forms.

Textbook 1: Chapter 14.1 to 14.3

Module-5 Emerging Database Technologies and Advance Database Model (8 hours)

Emerging Database Technologies: Mobile Data Management, Multimedia Data Management, Geographic Information System(GIS).

Advanced Database Models and Application: Active Database Concepts and Trigger, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts.

Textbook 1: Chapter 23.1 to 23.3 , Chapter 24.1 to 24.4

Course Outcomes: At the end of the course the student will be able to:	
21CSE6041.1	Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram

21CSE6041.2	Construct a physical model of a database from its logical model by using relational algebra and SQL.
21CSE6041.3	Design a database application system and use advanced SQL tools using SQL interface and JDBC.
21CSE6041.4	Design real-life Database Application by applying normalization techniques
21CSE6041.5	Analyze the use of Emerging Database Technologies
21CSE6041.6	Apply the advance Database Model Concepts

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Database Systems	Ramez Elmasri and Shamkant B. Navathe	Pearson	6th Edition, 2010
Reference Books				
1	Database management systems	Ramakrishnan, and Gehrke	McGraw Hill	3rd Edition, 2014
2	Database System Concepts	Silberschatz Korth and Sudharshan	Mc-GrawHill	6th Edition, 2013

Web links and Video Lectures (e-Resources):

- **SQL Tutorials For Beginner's:** https://www.youtube.com/watch?v=LGTbdjoEBVM
- **DBMS Full Coarse for Beginner's:** https://www.youtube.com/watch?v=c5HAwKX-suM
- **Java JDBC Tutorials:** https://www.youtube.com/watch?v=3OrEsC-QjUA
- **SQL:** https://www.w3schools.com/sql/
- **Introduction to DBMS:** https://www.youtube.com/watch?v=6Iu45VZGQDk

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE6041.1	2													
21CSE6041.2		1		1										
21CSE6041.3		1			1									
21CSE6041.4	1	1										1		
21CSE6041.5	1	1			1									
21CSE6041.6	1	1										1		

1: Low 2: Medium 3: High

Introduction to Programming in Java			
Course Code	**21CSE6042**	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: The objective of the course is to

- Discuss the fundamental features of object oriented language and JAVA.
- Use Java JDK environment to create, debug and run simple Java programs.
- Demonstrate object oriented concepts using programming examples.
- Discuss the concepts of importing packages and exception handling mechanisms.

Module-1 An Overview of Java and Data Types, Variables, and Arrays (8 hours)

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries.

Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Textbook 1: Chapter 2, Chapter 3

Module-2 Operators and Control Statements (8 hours)

Operators: Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.
Control Statements: Java' Selection Statements, Iteration Statements, Jump Statements.
Textbook 1: Chapter 4, Chapter 5

Module-3 Introducing Classes (8 hours)

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, Garbage Collection, The finalize( ) Method.
Textbook 1: Chapter 6

Module-4 A Closer Look at Methods and Classes and Inheritance (8 hours)

A Closer Look at Methods and Classes: Overloading Methods, Introducing Access Control, Understanding static, Introducing final.

Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Using Abstract Classes, Using final with Inheritance.

Textbook 1: Chapter7, Chapter 8

Module-5 Packages and Exception-Handling (8 hours)

Packages : Packages, Importing Packages
Exception-Handling : Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, throw, throws, finally
Textbook 1: Chapter 9, Chapter 10

Course Outcomes: At the end of the course the student will be able to:	
21CSE6042.1	Illustrate the features and object oriented concepts in JAVA programming
21CSE6042.2	Summarize working of operators and control statements in JAVA
21CSE6042.3	Write programs based on polymorphism and inheritance

21CSE6042.4	Outline the concepts of packages and Interfaces
21CSE6042.5	Construct the programs using the concepts of exception handling mechanism
21CSE6042.6	Build simple java programs to solve real world problems

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Java The Complete Reference	Herbert Schildt	Tata McGraw Hill	7th Edition, 2007
Reference Books				
1	Programming with Java	Mahesh Bhave, Sunil Patekar	Pearson	1st Edition, 2008
2	Java How to Program	Paul Deitel, Harvey Deitel	Pearson	11th Edition, 2018

Web links and Video Lectures (e-Resources):

- **Programming in Java:** https://onlinecourses.nptel.ac.in/noc22_cs47/preview
- **Exception Handling in Java:** https://youtu.be/y-NlcLcxiKY
- **Differences between Method Overloading and Method Overriding in Java:** https://www.youtube.com/watch?v=xO22_4V5JgU https://youtu.be/CLzgS08equQ

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE6042.1	1	1		1	1	2						1	1	1
21CSE6042.2	1		1	1									1	2
21CSE6042.3			1	1			1			1		1		
21CSE6042.4										1	1	1		
21CSE6042.5		1	1						1			1		1
21CSE6042.6	2	1	1	1	1	3	1			1			1	1

1: Low 2: Medium 3: High

Dot Net Programming			
Course Code	**21CSE6043**	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: The objective of the course is to

- Learn the syntax and semantics of C#
- Understand Object Oriented Programming concepts in C#.
- Interpret Interfaces and define custom interfaces for applications.
- Implement properties, indexers, generics and collections in C#

Module-1 Introducing Microsoft Visual C# (8 hours)

Introducing Microsoft Visual C#: Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements
Text Book 1: Chapter 2 - 4

Module-2 Understanding loops, exceptions and the C# object model (8 hours)

Using compound assignment and iteration statements, Managing errors and exceptions, Creating and Managing classes and objects
Text Book 1:Chapter 5 - 7

Module-3 Arrays and Parameters (8 hours)

Understanding values and references, Creating value types with enumerations and structures, Using arrays, Understanding parameter arrays
Text Book 1: Chapter 8 - 11

Module-4 Inheritance and Resource Management (8 hours)

Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management
Text Book 2: Chapter 12 - 14

Module-5 Defining Extensible Types with C# (8 hours)

Implementing properties to access fields, Using indexers, Introducing generics (up to Generics and constraints), Using collections (up to The Stack <T> collection class)
Text Book 3: Chapter 15 - 18

Course Outcomes: At the end of the course the student will be able to:	
21CSE6043.1	Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#
21CSE6043.2	Manage errors and handle exceptions in C#
21CSE6043.3	Demonstrate Object Oriented Programming concepts in C# programming language
21CSE6043.4	Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
21CSE6043.5	Demonstrate garbage collection and resource management in C#
21CSE6043.6	Illustrate the use of properties, indexers, generics and collections in C#

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Microsoft Visual C# Step by Step	John Sharp,	PHI Learning Pvt. Ltd.	8th Edition, 2016
Reference Books				
1	C# 6 and .NET Core 1.0	Christian Nagel	Wiley India Pvt Ltd	1st Edition, 2016
2	Essential C# 6.0	Mark Michaelis	Pearson Education India	5th Edition, 2016

Web links and Video Lectures (e-Resources):

- https://dotnet.microsoft.com/en-us/
- https://www.javatpoint.com/net-framework
- https://dotnettutorials.net/
- https://github.com/topics/dotnet

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSE6043.1														2
21CSE6043.2														2
21CSE6043.3														2
21CSE6043.4														2
21CSE6043.5					2								2	
21CSE6043.6					2						2		2	

1: Low 2: Medium 3: High

Introduction to Python			
Course Code	**21CSE6044**	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: The objective of the course is to

- Apply the syntax and semantics of the Python programming language.
- Illustrate the process of structuring the data using lists, tuples, Dictionaries.
- Implement looping constructs and functions to manipulate strings.
- Demonstrate the use of built-in functions to work with different types of files.
- Implement the program for working with JSON data

Module-1 Python Basics and Control Flow (8 hours)

Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program**.**

Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit()

Textbook 1: Chapters 1 – 2

Module-2 Python Functions and Lists (8 hours)

Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling.

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References.

Textbook 1: Chapters 3– 4

Module-3 Dictionaries and Strings in Python (8 hours)

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Nested Dictionaries

Manipulating Strings: Working with Strings, Useful String Methods, Project: Adding Bullets to Wiki Markup

Textbook 1: Chapters 5-6

Module-4 Pattern Matching with Regular Expressions in Python (8 hours)

Pattern Matching with Regular Expressions: Finding Patterns of Text without Regular expression, Finding Patterns of Text with Regular expression, More Pattern Matching with Regular Expression, Greedy and Non-greedy matching, Findall() method, Character classes, Making your own character classes, the Caret and Dollar sign Characters, Wildcard Characters, Case-insensitive matching, Substituting strings with sub() method.

Textbook 1:Chapters 7

Module-5 Working with different types of files in Python (8 hours)

Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function.

Working with Excel Spreadsheets: Excel Documents, Installing the open pyxl Module, Reading Excel Documents

Working with CSV files and JSON data: The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module

Textbook 1: Chapters 11 – 14

Course Outcomes: At the end of the course the student will be able to:	
21CSE6044.1	Implement python programs to solve problems using flow control and decision-making constructs.
21CSE6044.2	Implement looping constructs and functions in python programs and Design, create and execute python programs to solve problems using lists.
21CSE6044.3	Design, create and execute python programs to solve problems using core data structures like dictionaries and Implement Python Programs using Strings
21CSE6044.4	Implement regular expressions in python program
21CSE6044.5	Develop a python program to work with different types of files
21CSE6044.6	Develop programs for working with JSON data.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Automate the Boring Stuff with Python	Al Sweigart	No Starch Press	1st Edition, 2015
Reference Books				
1	Python for Everybody: Exploring Data Using Python 3	Charles R. Severance	Shroff Publishers	1st Edition, 2017
2	Introduction to Computer Science Using Python	Charles Dierbach,	Wiley	1st Edition, 2015
3	Introduction to Python Programming	Gowrishankar S, Veena A,	CRC Press	1st Edition, 2018

Web links and Video Lectures (e-Resources):

- https://www.learnbyexample.org/python/
- https://www.learnpython.org/
- https://pythontutor.com/visualize.html#mode=edit

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE6044.1			2											
21CSE6044.2			2											
21CSE6044.3			2											
21CSE6044.4			2		2									
21CSE6044.5			2											
21CSE6044.6		2			2									

1: Low 2: Medium 3: High

Environmental Studies			
Course Code	**21CIV605**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	1:0:0	SEE Hours	02
Total Hours	15 hours Theory	Credits	01

Course Learning Objectives: This course will enable

- To create environmental awareness among the students.
- To gain knowledge on different types of pollution in the environment.

Module-1 Introduction to Ecology **3 hours**

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module-2 Energy Systems and Natural Resources **3 hours**

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, case studies, and Carbon Trading.

Module-3 Environmental Pollution and Public Health **3 hours**

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module-4 Environmental Concerns **3 hours**

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module-5 Environmental Management **3 hours**

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

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

21CIV605.1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale
21CIV605.2	Develop critical thinking and/or observation skills and apply them to the analysis of a problem or question related to the environment.
21CIV605.3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic component.
21CIV605.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
21CIV605.5	Address problems related to waste management and public health aspects
21CIV605.6	Understand about the Standards and latest tools to mitigate pollution.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Environmental studies	Benny Joseph	Tata McGraw-Hill	Edition 3, 2018
2	Environmental Studies –From Crisis to Cure	R Rajagopalan	Oxford Uni-Press	Edition 3, 2020
Reference Books				
1	A Basic Course in Environmental Studies	Surinder Deswal, Anupama Deswal	DhanpatRai Publishing Co. (P) Ltd	2017
2	Text book of Environmental Studies for Undergraduate Courses	Bharucha Erach	Universities Press	Edition 2, 2017
3	Environmental Studies	Ranjit R. J Daniels, Jagdish Krishnaswamy	John Wiley & Sons Inc.	2010
4	Perspective in Environmental Studies	Anubha Kaushik, C P Kaushik	New Age International Pvt. Ltd	Edition 3, 2009

Web links and Video Lectures (e-Resources):

- Coursera Course: Introduction to Environmental Science Specialization - https://coursera.org/share/e6c3c98f7215fd49f688e7ede71a0dfc
- NPTEL: Environmental Studies - https://onlinecourses.swayam2.ac.in/cec22_ge22/preview
- Directory of Open Access Books (DOAB) -Environmental Leadership Capacity Building in Higher Education: Experience and Lessons from Asian Program for Incubation of Environmental Leaders : http://link.springer.com/openurl?genre=book&isbn=978-4-431-54339-8
- Lec 31: Environmental Management Systems (EMS) - https://youtu.be/BYqLRGawoH0
- ISO 14001:2015 Training - Environmental Management - https://youtu.be/2f4pBIvXkBs

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CIV605.1	0	0	0	0	0	1	3	0	0	0	0	0	0	0
21CIV605.2	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.3	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.4	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.5	0	0	0	0	0	2	3	1	0	0	0	0	0	0
21CIV605.6	0	0	0	0	1	0	0	2	0	0	0	0	0	0

1: Low 2: Medium 3: High

Web Programming Laboratory			
Course Code	**21CSL606**	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 Hours
Total Hours	20	Credits	01

Course Learning Objectives: The objective of the course is to

- To gain knowledge on designing static and dynamic web pages.
- Able to validate web pages at client-side.
- Gain knowledge on server side scripting
- Understand the basics of React and create components and lifecycle
- Develop applications using JSX and React.
- Develop application using server session handling technique.

Experiments (8 hours)

A–Demonstration (offline/virtual):

A1. Create a webpage with HTML describing your department. Use paragraph and list tags.

A2. Apply various colors to suitably distinguish key words. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.

A3. Create links on the words e.g. “Wi-Fi” and “LAN” to link them to Wikipedia pages.

A4. Insert an image and create a link such that clicking on image takes user to other page.

A5. Change the background color of the page. At the bottom create a link to take user to the top of the page.

B–Exercise (compulsorily to be conducted):

B1. i Create a table to show your class time-table.(CSS and HTML)
ii Include course name, instructors, days of week and time slots. Include at least 5 courses and make sure the table is properly formatted with appropriate table headers, rows and cells.
iii. Write an HTML page that contains a selection box with a list of 5 countries, when the user

B2. Select a country its capital should be printed next to the list; Add CSS to Customize the properties of font of the capital(color,bold,and font size)

B3. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient (Java Script)
i Build your own Button component and render it three times. On user click, it should alert which button was clicked. (React JS).
ii Use the useState React hook to track how many times a button is clicked, and display the number

B4. create a custom component that displays each item from
['dog', 'cat', 'chicken', 'cow', 'sheep', 'horse']
Instead of using the <ul> and <li> HTML tags, create a custom component that accepts a list as its prop, and renders it accordingly.

B5. Build a form that accepts a first name and a last name. And instead of a boring "Submit" button, make a button that says "Greet Me" that when clicked, will alert "Hello [first name] [last name]!".

B6. Create a custom component for rendering each joke present in an array. Using the map function, map through each object in the array. Use the custom component to render each object.

C–Structured Enquiry (compulsorily any 4 to be conducted):

C1. Create an HTTP server listening on port 1337, which sends Hello, World! to the browser and using Express.

C2. Create a server which send the response as listed below.
i)Send response using status() function.
ii)Send some particular data to the client using send() function

i) Sending the JSON response from the server to the client using json()
Store and retrieve the data with Node.js, Express and MongoDB.

C3. Implement a node.js and MongoDB application using the express framework and mongooseORM that supports pagination for retrieving and displaying posts from the database.

C4. Create a website which reports the weather for a specific city using NodeJS to send API requests to Accuweather, and pug and CSS to present the weather to the users.

C5. Create a Tic Tac Toe game using React JS

Course Outcomes: At the end of the course the student will be able to:	
21CSL606.1	Apply HTML and CSS syntax and semantics to build web pages.
21CSL606.2	Construct and visually format forms using HTML and CSS.
21CSL606.3	Develop Client-Side Scripts using JavaScript.
21CSL606.4	Apply the concepts of React to create Components.
21CSL606.5	Develop applications using React JSX.
21CSL606.6	Design applications using the Lifecycle methods and Component.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar	Pearson Education India	1st Edition, 2015
2	React: Up & Running: Building Web Applications	Stoyan Stefanov	O'Reilly Media, Inc.	2nd Edition, 2021
Reference Books				
1	Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5	Robin Nixon	O'Reilly Publications	4th Edition, 2015
2	Professional JavaScript for Web Developers	Nicholas C Zakas	Wrox/Wiley India	3rd Edition, 2012
3	Fullstack React: The Complete Guide to ReactJS and Friends	Anthony Accomazzo, Ari Lerner, Nate Murray, Clay Allsopp, David Gutman, Tyler McGinnis	Fullstack.io	1st Edition, 2017

Web links and Video Lectures (e-Resources):

- **HTML Tutorial For Beginners 2023:** https://www.youtube.com/watch?v=OUjU--gVylE
- **CSS Tutorial - Zero to Hero:** https://www.youtube.com/watch?v=1Rs2ND1ryYc
- **JavaScript Full Course:** https://www.youtube.com/watch?v=o1IaduQICO0
- **What Is ReactJS?:** https://www.youtube.com/watch?v=Y6aYx_KKM7A
- **React JS Full Course For Beginners 2020:** https://www.youtube.com/watch?v=CI2kX2EFhWc
- **Workshop trial**: https://www.coursera.org/programs/faculty-development-workshop-trial-2-c9g2g/projects/basic-server-nodejs
- **What Is Node.js?:** https://www.youtube.com/watch?v=8u1o-OmOeGQ
- **Node.js:** https://nodejs.dev/en/learn/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CSL606.1	2	1												
21CSL606.2	3		1	1										
21CSL606.3	2	1			1							1		
21CSL606.4	2	1												
21CSL606.5	1										1			
21CSL606.6	1	1									1			

1: Low 2: Medium 3: High

Cryptography and Cyber Security			
Course Code	**21CSE607**	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: The objective of the course is to

- Define symmetric ciphers and their characteristics, including substitution ciphers, transposition ciphers, and block ciphers.
- Illustrate the different cryptographic operations of public key cryptography
- Examine the different techniques used in key exchange protocols.
- Comprehend the cybercrime terminologies and perspectives
- Gain knowledge on tools and methods used in cybercrimes

Module-1 Symmetric Ciphers (8 hours)

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

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

Case study: Implement the following cipher techniques: i. Substitution Cipher, ii. Transposition Cipher. **Text book 1: Chapter3: 3.1 to 3.3, Chapter4: 4.1 to 4.4**

Module-2 Asymmetric Ciphers (8 hours)

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

The RSA algorithm: Description of the Algorithm, Computational Aspects, The security of RSA. Diffie-Hellman Key Exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.

Case Study: Implement RSA algorithm. **Text book 1: Chapter 9: 9.1, 9.2, Chapter 10: 10.1,10.2**

Module-3 Cryptographic Data Integrity Algorithms (8 hours)

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

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions.

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

Case study: Implement the Signature Scheme - Digital Signature Standard

Text book 1: Chapter 11:11.1, 11.2, 11.5, Chapter 12: 12.1 to 12.4, Chapter 13: 13.1, 13.2

Module-4 Introduction to Cybercrime (8 hours)

Cybercrime: Definition and Origins of the Word, Cybercrime, and Information Security, who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives.

Case study: A report on recent cybercrimes in India. **Text book 2: 1.1 to 1.5, 1.7-1.9**

Module-5 Tools and Methods used in Cybercrime (8 hours)

Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyware, Virus and Worms, Trojan Horses and Backdoors, DoS and DDOS Attacks. Phishing and Identity Theft: Introduction, methods of phishing, phishing techniques, types of phishing scams, phishing toolkits and spy phishing, counter measures.

Case study: SQL Injection, **Text book 2: 4.1 to 4.9**

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

21CSE607.1	Analyze the security of classical encryption methods and the vulnerabilities that can be exploited to break their security.

21CSE607.2	Illustrate various block ciphers and symmetric cryptographic algorithms.
21CSE607.3	Apply asymmetric encryption techniques to solve cryptographic problems.
21CSE607.4	Utilize the concepts of message authentication codes, hash functions and digital signing techniques for ensuring secure transactions.
21CSE607.5	Explain the cybercrime terminologies and the various cyber laws.
21CSE607.6	Demonstrate Tools and Methods used on Cybercrime, and phishing.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Cryptography and Network Security	William Stallings	Pearson Education	7th Edition, 2017
2	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Sunit Belapure and Nina Godbole	Wiley India Pvt Ltd	1st Edition (Reprinted 2018)
Reference Books				
1	Cryptography and Network Security.	Behrouz A. Ferouzan, Debdeep Mukhopadhyay,	Tata Mc Graw Hill	3rd Edition, 2015
2	Introduction to Security and Network Forensics	Buchanan,William J.	CRC Press	1st Edition, 2011
3	Security in Computing	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies	Prentice Hall, New Delhi	5th Edition, 2015

Web links and Video Lectures (e-Resources):

- **Data Encryption Standard:** https://www.simplilearn.com/what-is-des-article
- **RSA Algorithm:** https://www.khanacademy.org/computing/computer-science/cryptography
- **SHA Algorithm:** https://www.simplilearn.com/tutorials/cyber-security-tutorial/sha-256-algorithm
- **What is Cybercrimes? Types, Tools, Examples:** https://www.guru99.com/cybercrime-types-tools-examples.html
- **SQL Injection:** https://www.w3schools.com/sql/sql_injection.asp

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE607.1	2	1	1	1								1		1
21CSE607.2	2	1	1	2	2							1		2
21CSE607.3	2	1	1	2	1		1			1		1		1
21CSE607.4	2	1	1		1							1		
21CSE607.5	1	1	1			3		1	2			1	3	1
21CSE607.6	1	1	1	1	1		1	1		1				1

1: Low 2: Medium 3: High

Innovation and Intellectual Property			
Course Code	**21IIP609**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	-
		Total Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE	2 Hours
Total Hours	20 Hrs	Credits	-

Course Learning Objectives:

1. Learn how to use online databases and search tools for conducting patent searches.
2. Develop skills in analyzing patent documents and identifying relevant prior art.
3. Gain proficiency in evaluating the patentability criteria for engineering inventions.
4. Understand the principles of technology gap analysis and patentability search.
5. Understand the patent drafting and patent prosecution.

Module-1 Basics of Intellectual Property Rights (4 Hours)

Creativity, Invention, and Innovation – Introduction to Intellectual Property Rights-types and Importance – Overview of Patent Law – Intellectual Property Management and Commercialization – Emerging Issues in Intellectual Property – Case Studies and Practical Examples – Ethical and Social Considerations.

Activity: Trademark Design Challenge – IP Case Study Analysis

Module-2 Patent Landscape Analysis – Technology Gap Analysis (4 Hours)

Overview of Patent Databases and Search Tools – Keyword Searching, Classification Searching, and Citation Searching – Methods for Analyzing Patent Data: Patent Counts, Citation Analysis, and Patent Mapping – Technology Gap Analysis – Patent Portfolios – Portfolio Strength Assessment – Identification of Key Players – Competitive Intelligence and Market Analysis.

Activity: Conduct Patent Landscape Analysis for the Proposed Capstone Project.

Module-3 Patentability Assessment (6 Hours)

Significance of Patentability Assessment – Patentability Criteria: Novelty, Non-obviousness (Inventive Step), and Industrial Applicability/Utility – Prior Art Searching and Analysis (Keyword Searching, Classification Searching, and Citation Searching) – Non-Patent Literature Search and Other sources of Prior Art – Patentability Reports and Assessments – Case Studies and Practical Examples.

Activity: Conduct a Patentability Search for the Proposed Capstone Project.

Module-4 Patent Drafting and Prosecution (6 Hours)

Significance of Patent Drafting and Prosecution – Structure and Components of a Patent Application – Drafting of Patent Specifications, Claims, and Drawings – Overview of Patent Prosecution Process

Activity: Prepare a Patent Draft for the Proposed Capstone Project.

Course Outcomes: At the end of the course, the student will be able to:	
21IIP609.1	Demonstrate proficiency in utilizing various online databases and search tools for conducting patent searches.
21IIP609.2	Develop advanced skills in analyzing patent documents to identify relevant prior art, including patents, patent applications, and non-patent literature.
21IIP609.3	Demonstrate a comprehensive understanding of the patentability criteria, including novelty, non-obviousness, and utility.

21IIP609.4	Explain the principles and methodologies of technology gap analysis and its relevance to patentability searches.
21IIP609.5	Gain insight into the patent drafting process, including the structure and components of patent applications, and patent prosecution.
21IIP609.6	Apply the acquired knowledge and skills in conducting practical activities, such as conducting patent landscape analysis, patentability searches, and drafting patent applications, to solve real-world problems and challenges in the field of intellectual property rights.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books/Sources				
1	Intellectual Property- A Primer for Academia (For Module 1)	Rupinder Tewari Mamtha Bhardway	Publication Bureau, Panjab University Chandigarh India	2021
2	Patent Landscape Reports (For Module 2)	WIPO - World Intellectual Property Organization		https://www.wipo.int/patentscope/en/programs/patent_landscapes/
3	Guidelines for Preparing Patent Landscape Reports (For Module 2)	Anthony Trippe, Patinformatics, LLC	World Intellectual Property Organization (WIPO)	2015
4	Patent Searching - Tools and Techniques (For Module 3)	David Hunt	John Wiley & Sons Inc	First edition 2007
5	The Complete Patent Book_ Everything You Need to Obtain Your Patent (For Module 4)	James L. Rogers	Sphinx Publishing	First Edition 2003

Additional Resources:

1. WIPO Patent Drafting Manual - Second Edition 2023, https://www.wipo.int/edocs/pubdocs/en/wipo-pub-867-23-en-wipo-patent-drafting-manual.pdf
2. Patent Drafting for Beginners - https://elearn.nptel.ac.in/shop/nptel/patent-drafting-for-beginners/?v=c86ee0d9d7ed
3. The Office of the Controller General of Patents, Designs and Trade Marks, Government of India - https://www.ipindia.gov.in/
4. Copyright Office, Government of India - https://copyright.gov.in/
5. United States Patent and Trademark Office - https://www.uspto.gov/
6. Espacenet – patent search - https://worldwide.espacenet.com/
7. The Lens - Free & Open Patent and Scholarly Search - https://www.lens.org/
8. WIPO PATENTSCOPE - https://patentscope.wipo.int/search/en/search.jsf

Course Articulation Matrix

Course Outcomes (Cos)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21IIP609.1	2	-	-	-	3	-	-	-	-	-	-	1	-	-
21IIP609.2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
21IIP609.3	3	-	-	-	-	-	-	-	-	-	1	-	-	-
21IIP609.4	2	-	3	-	-	-	-	-	-	-	-	-	-	-
21IIP609.5	1	3	-	-	-	-	-	-	-	-	-	2	-	-
21IIP609.6	-	-	-	-	2	-	-	-	-	-	-	3	-	-

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

Vamanjoor, Mangaluru - 575 028, Karnataka, India
Ph: 91-824-2868100 / 2263753 / 54 / 55
E-mail: sjec@sjec.ac.in| Website: www.sjec.ac.in