NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Science and Engineering

Academic Year
2023-24

M.Tech (CSE) 3rd and 4th Semester
Scheme & Syllabus 2023-24
BATCH: 2022-24
CREDITS: 80

Department of Computer Science and Engineering

Academic Year 2023-24

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New Horizon College of Engineering, Bangalore

Autonomous College affiliated to VTU, Accredited by NAAC with 'A' Grade & NBA

INSTITUTE VISION AND MISSION

<u>VISION</u>

To emerge as an institute of eminence in the fields of engineering, technology and managementin serving the industry and the nation by empowering students with a high degree of technical,managerial and practical competence.

<u>MISSION</u>

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students

- To encourage long-term interaction between the academia and industry through theirinvolvement in the design of curriculum and its hands-on implementation

- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To emerge as a department of eminence in Computer Science and Engineering in serving the Information Technology Industry and the nation by empowering students with a high degree of technical and practical competence.

MISSION

➢ To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering

➢ To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation

➢ To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities

PROGRAM OUTCOMES (POs)

The student will be able to:

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

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems in Computer Science and Engineering reaching substantiated conclusionsusing first principles of mathematics, natural sciences and engineering sciences.

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

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

PO5: Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities related to Computer Science and Engineering with an understanding of the limitations.

PO6: 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 in Computer Science and Engineering.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions of Computer Science and Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual and as a member orleader to diverse teams, and in multidisciplinary settings.

PO10: 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 report and design documentation, make effective presentations, and give and receive clear instructions.

PO11: 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 leader in a team, to manage projects and in multidisciplinary environments.

PO12: 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)

The student will be able to:

PSO1: Ability to design, develop, implement computer programs and use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

PSO2: Work with and communicate effectively with professionals in various fields and pursue lifelong professional development in computing.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Graduate of the program will be able to:

PE01: Develop proficiency as computer scientists with an ability to solve a wide range of computational problems in industry, government, or other work environments.

PE02: Attain the ability to adapt quickly to new environments and technologies, assimilate new information, and work in multi-disciplinary areas with a strong focus on innovation and entrepreneurship.

PE03: Possess the ability to think logically and the capacity to understand technical problems with computational systems.

PE04: Possess the ability to collaborate as team members and team leaders to facilitate cutting-edge technical solutions for computing systems and thereby providing improved functionality.

NEW HORIZON COLLEGE OF ENGINEERING
M.Tech Computer Science and Engineering
Scheme of Teaching and Examinations for 2022 - 2024 BATCH (2022 Scheme)

S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
			III - Semester										
1	PCC/CSE	22SCS31	Advanced Computer Network & Security	CSE	3	0	0	1	4	5	50	50	100
2	PEC/CSE	22SCS32X	Professional Elective – 3	CSE	3	0	0	0	3	3	50	50	100
3	OEC/DEP	20NHOPXXX	Open Elective Courses	CSE	3	0	0	0	3	3	50	50	100
4	PROJ/CSE	22SCS34	Project Work Phase – 1	CSE	0	0	3	0	3	-	100	--	100
5	SP/CSE	22SCS35	Societal Project	CSE	0	0	3	0	3	-	100	--	100
6	INT/CSE	22SCSI36	Internship (6 wks Internship completed during the intervening vacation of II & III semesters.)	CSE	0	0	6	0	6	-	50	50	100
Total									22	11	400	200	600

Important Note: During the 3rd semester, students should enroll in and finish the recommended BOS Online (NPTEL) Courses for the 4th semester, as the evaluation will take place during the 4th semester.

Legends: PCC: Professional core courses, **PEC:** Professional Elective Courses, **IPCC**-Integrated Professional Core Courses. **MPS**-Mini Project With Seminar; **AUD/AEC**; Audit Courses/ Ability Enhancement Courses (Mandatory), **PCCL** – Professional Core Course lab, **L** - Lecture, **P**-Practical, **T / SDA**-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students)

Professional Elective – 3	
Course Code	**Course Title**
22SCS321	Cyber Security Management
22SCS322	Design Thinking
22SCS323	Entrepreneurship & Innovation Management
22SCS324	Geographic Information Systems
22SCS325	Bioinformatics

20NHOPXXX – Open Elective Courses			
20NHOP601	Big Data Analytics using HP Vertica- 1	20NHOP615	Product Life Cycle Management
20NHOP602	VM Ware Virtualization Essentials-1	20NHOP618A	Physical Design
20NHOP607	SAP	20NHOP620A	Robotic Process Automation
20NHOP608	Schneider - Industrial Automation	20NH0P621A	Industry 4.0
20NHOP609	Cisco - Routing & Switching – 1	20NHOP622A	Programming of Industrial Robot
20NHOP614	Blockchain	20NHOP623A	5G Communication

Note:

Project Work Phase-1: It's an opportunity for students to look into into real-world challenges, applying theoretical knowledge to practical scenarios. This phase typically involves project selection, literature review, problem identification, and proposal formulation.

Societal Project: Aims to bridge technology with societal needs. It encourages students to address real-world challenges by leveraging their technical expertise for societal betterment. This initiative fosters a sense of responsibility, innovation, and ethical application of technology in creating solutions that positively impact communities.

Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

NEW HORIZON COLLEGE OF ENGINEERING
M.Tech Computer Science and Engineering
Scheme of Teaching and Examinations for 2022 - 2024 BATCH (2022 Scheme)

IV – Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	Project/ CSE	22SCS41	Project work phase – 2	CSE	0	0	18	0	18	-	100	100	200
2	AUD/AEC	22MOOC2	BOS Recommended Online Courses	CSE	Classes and evaluation procedures are as per the policy of the on line course providers.								PP
Total									18	-	100	100	200

Note:

ProjectWorkPhase-2: Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism

check, shall be as per the University norms.

Total Credits 22+18+22+18 = **80**

Third Semester Syllabus

ADVANCED COMPUTER NETWORK & SECURITY				
Course Code	**22SCS31**	**CIE Marks**	**50**	
L:T:P:S	**3:0:0:1**	**SEE Marks**	**50**	
Hrs / Week	**3**	**Total Marks**	**100**	
Credits	**04**	**Exam Hours**	**03**	

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

22SCS31.1	Reflect on the hurdles in networking, specifically differentiating between the TCP/IP and the 7-Layer OSI model.
22SCS31.2	Categorize various routing protocols for a range of applications.
22SCS31.3	Apply various wireless networks, including ad-hoc networks with their associated protocols.
22SCS31.4	Assess different switching protocols.
22SCS31.5	Investigate protocols used in wide area networks and their practical, real-time applications.
22SCS31.6	Formulate the significance of network security prerequisites in real-time applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS31.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
22SCS31.2	3	3	3	-	-	-	-	-	-	-	-	2	3	-
22SCS31.3	3	3	-	2	-	-	-	-	-	-	-	2	3	-
22SCS31.4	3	3	3	2	-	-	-	-	-	-	-	2	3	-
22SCS31.5	3	3	3	-	-	-	-	-	-	-	-	2	3	-
22SCS31.6	3	3	-	-	-	-	-	-	-	-	-	2	3	-

MODULE-1	**COMPUTER NETWORKS AND MODELS**	**22SCS31.1**	**8 Hours**

Computer Networks and the Internet: History of Computer Networking and the Internet, Networking Devices, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones.
Networking Models: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing, Equal Sized Packets Model: ATM

Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16		
MODULE-2	**NETWORK ROUTING AND ITS CONCEPTS**:	**22SCS31.2**	**8 Hours**

Network Routing and its concepts: Structure of a Router, Basic Router Configuration, Building a Routing Table, Static Routing, Dynamic Routing – Distance Vector Routing Protocol (RIPv1, RIPv2, EIGRP), Link State Routing Protocols (OSPF)

Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15		
MODULE-3	**WIRELESS & ADHOC NETWORKS**	**22SCS31.3, 22SCS31.4**	**8 Hours**

Wireless LANS and PANS, Wireless WANS and MANS, AD HOC Wireless Networks, Wireless Sensor Networks, Wireless Body Area Networks, IEEE 802.11 MAC Layer Fundamentals: CSMA/CA, IEEE 802.11 MAC Layer, Advanced Routing Protocols for AD HOC Wireless Networks

Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**LAN SWITCHING & WANs**	**22SCS31.5**	**8 Hours**

LAN Switching: Switching and its Concepts: Structure of a Switch, Basic Switch Configuration, Virtual LANs, (VLANs), VLAN Trunking Protocol (VTP), Inter-VLAN Routing. Spanning Tree Protocol (STP).
Wide Area Networks (WANs): Introduction to WANs, Point-to-Point Protocol (PPP) concepts, Frame Relay concepts, Dynamic Host Configuration Protocol (DHCP), Network Address Translation (NAT), IPv6

Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**NETWORK SECURITY**	**22SCS31.6**	**8 Hours**

Security: Introduction, Overview, Security techniques, Cryptography: Concepts & Techniques, Symmetric Key Algorithm, Asymmetric Key Algorithm, Digital Signature and RSA, Internet Security Protocols, User

	Authentication, Electronic Mail Security, Firewall, IDS
Text Book	Text Book 2: 12.1 to 12.10
Skill Development Activity	1. Basic Router Configuration: • Setting up a small network using routers. • Perform the basic configuration steps such as setting the hostname, configuring interfaces (IP addresses, subnet masks), enabling interfaces, and securing access through passwords. 2. Build a Routing Table: • Manually configure routing tables on their routers using static routes, adding entries for different network destinations within their simulated network. 3. Dynamic Routing Protocols: • Demonstrate the setup of the suitable protocols and how they dynamically build and update routing tables

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s) - SDA	MCQ's
		25	15	10
L1	Remember	05	-	-
L2	Understand	05	-	-
L3	Apply	05	05	05
L4	Analyze	05	05	05
L5	Evaluate	05	05	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:
Text Books:
1) Behrouz A. Forouzan: Data Communication and Networking, 5th Edition Tata McGraw-Hill, 2013. (M1,2,5)
2) Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra

Reference Books:
1) Ad Hoc Wireless Networks, Pearson Education, C.Siva Ram Murthy, B.S. Manoj
2) Cryptography and Network Security, Tata McGraw-Hill, Atul Kahate
3) Protocols and Architectures for Wireless Sensor Networks, Paperback, Holger Karl, Andreas Willig

Web links and Video Lectures (e-Resources):
● **https://onlinecourses.nptel.ac.in/noc23_cs35/preview**
● **https://www.geeksforgeeks.org/network-security/**
● **https://web.eecs.umich.edu/~zmao/eecs589/notes/lec1.pdf**
● **https://www.javatpoint.com/computer-network-tutorial**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

● **Capture The Flag (CTF) Challenges**: Create computer security challenges that needs to identify vulnerabilities, exploit them, and defend against attacks. These exercises mirror real-world scenarios and boost problem-solving skills.

- **Network Simulation Labs**: Utilize network simulation tools like Cisco Packet Tracer or GNS3 to design and configure complex network topologies, experiment with different protocols, and troubleshoot issues.
- **Firewall Rule Configuration**: Work on configuring and fine-tuning firewall rules. They can set up rules for filtering network traffic, implementing port forwarding, and managing network security policies.
- **Wire shark Analysis**: Use Wire shark to capture and analyze network packets. Identify the suspicious activities, analyzing protocols, and learning to detect and mitigate network attacks.

Professional Elective - 3	
Course Code	**Course Title**
22SCS321	Cyber Security Management
22SCS322	Design Thinking
22SCS323	Entrepreneurship & Innovation Management
22SCS324	Geographic Information Systems
22SCS325	Bioinformatics

CYBER SECURITY MANAGEMENT				
Course Code	**22SCS321**		**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**		**SEE Marks**	**50**
Hrs / Week	**3**		**Total Marks**	**100**
Credits	**03**		**Exam Hours**	**03**

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

22SCS321.1	Understand the fundamental terminologies in the field of cyber security and the current threat landscape.
22SCS321.2	Analyze the diverse categories and attributes of cybercrimes, while synthesizing the appropriate protocols for reporting.
22SCS321.3	Apply legal framework in India concerning cybercrimes, including penalties and sanctions.
22SCS321.4	Summarize the matters pertaining to the privacy and security of personal data.
22SCS321.5	Identify the key elements of a cyber security strategy.
22SCS321.6	Assess risk-based evaluations, the necessity for security measures, and the requirement for cyber security audits and compliance.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS321.1	3	3	2	-	-	-	-	-	-	-	-	2	2	-
22SCS321.2	3	3	2	-	-	-	-	-	-	-	-	2	2	-
22SCS321.3	3	3	2	-	-	-	-	-	-	-	-	2	2	-
22SCS321.4	3	3	2	-	-	-	-	-	-	-	-	2	2	-
22SCS321.5	3	3	2	-	-	-	-	-	-	-	-	2	2	-
22SCS321.6	3	3	2	-	-	-	-	-	-	-	-	2	2	-

MODULE-1	Overview of Cyber security	22SCS321.1	8 Hours

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyber warfare, Case Studies.			
Text Book	Text Book 1: Chapter 1, 6, 7		
MODULE-2	**Cyber crimes**	**22SCS321.2**	**8 Hours**
Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransom ware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyber bullying, website defacement, Cyber squatting, Pharming, Cyber espionage, Crypto jacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.			
Self-study / Case Study / Applications	1. Describe various cyber crimes in the recent days with the details and lesson learned. 2. Platforms for reporting cyber crimes 3. Checklist for reporting cyber crimes online		
Text Book	Text Book 1: Chapter 2, 3		
MODULE-3	**Cyber Law**	**22SCS321.3**	**8 Hours**
Cyber crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.			
Text Book	Text Book 2: 1,2,3,4,5		
MODULE-4	**Data Privacy and Data Security**	**22SCS321.4** **22SCS321.5**	**8 Hours**
Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.			
Self-study / Case Study / Applications	1. Data Privacy and Data Security in Healthcare 2. Setting privacy settings on social media platforms. 3. Do's and Don'ts for posting content on Social media platforms. 4. Registering complaints on a Social media platform.		
Text Book	Text Book 3: 3, 4, 5, 6, 7		
MODULE-5	**Cyber security Management, Compliance and Governance**	**22SCS321.6**	**8 Hours**
Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.			
Self-study / Case Study / Applications	1. Explain the significance of cyber security management, compliance, and governance in today's digital landscape. Introduce the purpose of the report and the objectives of your self-study. 2. Prepare password policy for computer and mobile device. 3. List out security controls for computer and implement technical security controls in the personal computer. 4. List out security controls for mobile phone and implement technical security controls in the personal mobile phone. Log into computer system as an administrator and check the security policies in the system		
Text Book	Text Book 3: 8, 9, 10, 11		
Skill	**Activity-1: Enhance incident response and decision-making skill:** Create simulated		

Development Activity	scenarios (e.g., data breach, phishing attack). Form 2-member teams responsible for responding to the scenario, making decisions, and mitigating the cyber threat. perform discussion, analysis, and documentation of response strategies. **Activity-2: Security Policy Review - Review and update security policies and procedures where participants:** Assess existing security policies of any firm such as access control, data handling, and incident response. Identify gaps or outdated policies and propose revisions to ensure alignment with current threats and best practices.

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
\multicolumn{2}{c}{**RBT Levels**}	Test (s)	Qualitative Assessment (s) - SDA	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	10	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:
Text Books:
1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.

Reference Books:
1. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.
2. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
3. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

Web links and Video Lectures (e-Resources):
- https://www.cybrary.it/
- https://www.sans.org/
- https://academy.kaspersky.com/
- https://owasp.org/
- https://www.cisa.gov/cybersecurity

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Incident Response Simulations**: Create realistic incident scenarios and practice responding to security incidents. This could include scenarios like data breaches, malware infections, or denial-of-service attacks.

- **Security Policy Development:** Develop comprehensive security policies for various organizations. This includes crafting policies for access control, data protection, incident response, and compliance.

- **Risk Assessment and Management Workshops**: Conduct risk assessments for different organizations. They can identify potential threats, vulnerabilities, and the associated risks. Understand how to develop risk management plans to mitigate these risks.

- **Business Continuity and Disaster Recovery Planning**: Learn through the process of creating business continuity and disaster recovery plans. They can work on strategies for ensuring business operations continue in the event of a disruption.

<table>
<tr><td colspan="6" align="center">DESIGN THINKING</td></tr>
<tr><td>Course Code</td><td>22SCS322</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>L:T:P:S</td><td>3:0:0:0</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Hrs / Week</td><td>3</td><td>Total Marks</td><td>100</td></tr>
<tr><td>Credits</td><td>03</td><td>Exam Hours</td><td>03</td></tr>
</table>

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

22SCS322.1	Understand the concept of design thinking as it pertains to products and services.
22SCS322.2	Build the foundational ideas of innovation and design thinking.
22SCS322.3	Explore practical methods for applying design thinking in real-world scenarios.
22SCS322.4	Analyze the business models behind successful designs.
22SCS322.5	Acquire proficiency in tools used for design thinking.
22SCS322.6	Explore more on design thinking through real-life examples.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS322.1	3	3	3	3	2	-	-	-	-	-	-	2	3	-
22SCS322.2	3	3	3	3	2	-	-	-	-	-	-	2	3	-
22SCS322.3	3	3	3	3	2	-	-	-	-	-	-	2	3	-
22SCS322.4	3	3	3	3	2	-	-	-	-	-	-	2	3	-
22SCS322.5	3	3	3	3	2	-	-	-	-	-	-	2	3	-
22SCS322.6	3	3	3	3	2	-	-	-	-	-	-	2	3	-

MODULE-1	**PROCESS OF DESIGN**	**22SCS322.1**	**8 Hours**

Understanding Design thinking - Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping .

Self-study / Case Study / Applications	Introduction about the design thinking: Chalk and Talk method Theory and practice through presentation MVP and Prototyping through live examples and videos
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**TOOLS FOR DESIGN THINKING**	**22SCS322.2**	**8 Hours**

Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

Self-study / Case Study / Applications	Case studies on design thinking for real-time interaction and analysis Simulation exercises for collaborated enabled design thinking Live examples on the success of collaborated design thinking		
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15		
MODULE-3	**DESIGN THINKING IN BUSINESS**	**22SCS322.3, 22SCS322.4**	**8 Hours**

Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping

Self-study / Case Study / Applications	Case studies on design thinking and business acceptance of the design Simulation on the role of virtual eco-system for collaborated prototyping		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**DESIGN THINKING FOR STRATEGIC INNOVATIONS**	**22SCS322.5**	**8 Hours**

Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.

Self-study / Case Study / Applications	Business model examples of successful designs Presentation by the students on the success of design Live project on design thinking in a group of 2 students		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**DESIGN THINKING STAGES**	**22SCS322.6**	**8 Hours**

Design Thinking Stages - Empathize, Design, Ideate, Prototype and Test

Self-study / Case Study / Applications	Attend a design thinking workshop from the expert and then presentation by the students on their learning
Text Book	Text Book 2: 12.1 to 12.10
Skill Development Activity	**Activity-1: Design Challenge - Redesign Everyday Objects** **Objective:** Develop problem-solving and creativity skills by redesigning common objects. **Materials Needed:** Various everyday objects (pen, chair, mug, etc.), Drawing materials (paper, markers, pencils), Timer, Presentation space **Activity-2: Design Thinking Challenge - Redefine User Experiences** **Objective:** Develop empathy and problem-solving skills by redefining user experiences in specific scenarios. **Materials Needed:** Scenario cards (printed with different user scenarios or situations), Whiteboard or flip chart, Sticky notes, Markers

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
RBT Levels		**Test (s)**	**Qualitative Assessment (s)-SDA**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	-	-
L2	**Understand**	5	-	-
L3	**Apply**	5	5	5
L4	**Analyze**	5	5	5
L5	**Evaluate**	5	5	-
L6	**Create**	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:
Text Books:
1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.

Reference Books:
1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
2. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Web links and Video Lectures (e-Resources):
1. www.tutor2u.net/business/presentations/./productlifecycle/default.html
2. https://docs.oracle.com/cd/E11108_02/otn/pdf/./E11087_01.pdf
3. www.bizfilings.com
4. https://www.mindtools.com/brainstm.html
5. https://www.quicksprout.com/./how-to-reverse-engineer-your-competit
6. www.vertabelo.com/blog/documentation/reverse-engineering
7. http://dschool.stanford.edu/dgift/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Design Challenges**: Present the real-world design challenges and come up with innovative solutions. These challenges can range from product design to service design.

- **User Research and Empathy Activities**: Engage in activities that involve interacting with potential users or customers. They can conduct interviews, surveys, and observations to gain a deeper understanding of user needs and pain points.

- **Prototyping Workshops**: Learn to create prototypes using various tools and materials. Encourage them to build physical and digital prototypes to test their design concepts.

- **Design Thinking Workshops**: Participate design thinking workshops where students can work on real projects. These workshops can include brainstorming, ideation, and collaborative problem-solving activities.

- **Role-Playing Scenarios**: Engage in role-playing scenarios to understand user experiences and perspectives. This can help them to empathize with users and design solutions that address their needs.

- **Field Studies**: Plan field trips to observe and study real-world design challenges. They can gain insights from visiting companies, organizations, or places where design thinking is applied.

ENTREPRENEURSHIP & INNOVATION MANAGEMENT

Course Code	22SCS323	CIE Marks	50
L:T:P:S	3:0:0:0	SEE Marks	50
Hrs / Week	3	Total Marks	100
Credits	03	Exam Hours	03

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

22SCS323.1	Comprehend management fundamentals, including planning, decision-making, and the roles of managers in organizational contexts
22SCS323.2	Apply the management principles effectively in real-world scenarios to manage and lead teams, motivate employees, communicate efficiently, coordinate tasks, and maintain control
22SCS323.3	Apply the business practices and contribute to entrepreneurial development
22SCS323.4	Analyze the entrepreneurial opportunities, and conduct comprehensive feasibility analyses for potential business ventures.
22SCS323.5	Evaluate the effectiveness of business models, financial strategies, and project network plans, and evaluate their impact on successful entrepreneurial endeavors.
22SCS323.6	Demonstrate the ability to launch and manage entrepreneurial ventures successfully.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS323.1	3	3	3	-	-	-	-	-	1	1	-	2	3	-
22SCS323.2	3	3	3	-	-	-	-	-	1	1	-	2	3	-
22SCS323.3	3	3	3	-	-	-	-	-	1	1	-	2	3	-
22SCS323.4	3	3	3	-	-	-	-	-	1	1	-	2	3	-
22SCS323.5	3	3	3	-	-	-	-	-	1	1	-	2	3	-
22SCS323.6	3	3	3	-	-	-	-	-	1	1	-	2	3	-

MODULE-1	**Foundations of Management and Planning: Principles and Practice**	**22SCS323.1**	**8 Hours**

Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art &Profession Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision

Text Book	Text Book 1: Chapter 1

MODULE-2	**Foundations of Organizational Management and Control**	**22SCS323.2**	**8 Hours**

Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalization, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process. Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioral Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process.

Text Book	Text Book 1: Chapters 7, 8 ,9, 11, 15 to 18

MODULE-3	**Corporate Social Responsibility**	**22SCS323.3**	**8 Hours**

Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance, Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship				
Text Book	Text Book 1: Chapter 3, Text Book 2: Chapter 2			
MODULE-4	**Family Business Dynamics and Entrepreneurial Feasibility Analysis**		**22SCS323.4**	**8 Hours**
Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various types of family businesses. Idea Generation and Feasibility Analysis- Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities				
Text Book	Text Book 2: chapter 3			
MODULE-5	**Strategic Business Planning, Financing, and Project Network Analysis for Entrepreneurship**		**22SCS323.5, 22SCS323.6**	**8 Hours**
Business model – Meaning, designing, analyzing and improvising; Business Plan – Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some business plan fails? Financing and How to start a Business? Financial opportunity identification; Banking sources; Nonbanking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise & Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.				
Text Book	Text Book 2: Chapter 5, 7, 8. Text Book 3: Chapters 20.			
Skill Development Activity	**Activity-1: Innovation Hackathons** **Objective:** Enhance creativity, problem-solving, and teamwork **Activity:** Participate an innovation hackathon where participants work in teams on specific challenges or problems relevant to a chosen industry. Within a stipulated time (e.g., 24 hours) for ideation, prototyping, and pitching innovative solutions. **Activity-2: Entrepreneurial Case Studies Analysis:** **Objective:** Improve decision-making and problem-solving skills in an entrepreneurial context. **Activity:** In a given case studies of successful and failed entrepreneurial ventures, analyze these cases, identify key factors contributing to success or failure. Discuss lessons learned and strategies that could have been implemented differently.			

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	**Qualitative Assessment (s)-SDA**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	-	-
L2	**Understand**	5	-	-
L3	**Apply**	5	5	5
L4	**Analyze**	5	5	5
L5	**Evaluate**	3	5	-
L6	**Create**	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:
1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education2008,ISBN978-81-7758-260-4.

Reference Books:
1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4
2. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://biodesign.berkeley.edu/bioinspired-design-course/
- https://www.youtube.com/watch?v=cwxXY9Qe8ss
- https://www.youtube.com/watch?v=V2GvQXvjhLA
- https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design %20Workshop%20Report_2232327_October%202022_Final.508.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Startup Simulation Games**: Use entrepreneurship simulation games where students create and manage virtual startups, making decisions related to product development, marketing, and finance.

- **Business Model Canvas Workshops**: Work in teams to create business models using the Business Model Canvas. This hands-on activity encourages creativity and critical thinking.

- **Pitch Competitions**: Participate / Organize pitch competitions where students present their innovative business ideas to a panel of judges. This exercise helps to refine their pitching skills and business concepts.

- **Entrepreneurial Guest Speakers**: Invite successful entrepreneurs and innovators to share their experiences and insights with the class to provide real-world perspectives.

- **Idea Generation Workshops**: Participate brainstorming sessions and idea generation workshops to develop innovative concepts and products.

- **Design Thinking Workshops**: Collaborate design thinking methods, including empathy mapping, prototyping, and testing. These workshops can help them approach problem-solving in a human-centered way.

- **Innovation Challenges**: Present innovation challenges where students must come up with creative solutions to real-world problems.

- **Business Plan Development**: Learn through the process of developing comprehensive business plans, covering aspects like market analysis, financial projections, and risk assessment.

- **Incubator Programs**: Contribute on incubator program where students can work on their startup ideas with mentorship and resources.

- **Prototyping and Minimum Viable Product (MVP) Development**: Create prototypes or MVPs of their innovative products or services, allowing them to test their ideas in the real world.

GEOGRAPHIC INFORMATION SYSTEMS				
Course Code	**22SCS324**	**CIE Marks**	**50**	
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**	
Hrs / Week	**3**	**Total Marks**	**100**	
Credits	**03**	**Exam Hours**	**03**	

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

22SCS324.1	Understand the foundational principles underpinning Geographic Information Systems (GIS) and their role in various application areas
22SCS324.2	Develop competence by efficiently integrating and managing diverse geospatial data sources within GIS tasks
22SCS324.3	Apply the processing of geospatial data, adeptly managing and manipulating both raster and vector data while implementing necessary corrections
22SCS324.4	Demonstrate advanced proficiency in spatial data analysis, integration, and visualization techniques within GIS
22SCS324.5	Analyze complex spatial data by employing advanced techniques such as conducting trend surface analysis to model and understand spatial trends
22SCS324.6	Showcase a profound understanding of GIS analytical models, particularly Digital Terrain Models and hydrologic modeling, by effectively applying them in practical scenarios.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS324.1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
22SCS324.2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
22SCS324.3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
22SCS324.4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
22SCS324.5	3	3	3	-	3	-	-	-	-	-	-	2	3	-
22SCS324.6	3	3	3	-	3	-	-	-	-	-	-	2	3	-

MODULE-1	**Foundations of Geographic Information Systems and Spatial Data Models**	**22SCS324.1**	**8 Hours**

Introduction to GIS: Definitions, history and evolution, place of GIS in Geoinformatics, Components of GIS, interdisciplinary relations, Discrete geographic objects, Continuous geographic features, Vector and

Raster Data structures, GIS application areas, careers in GIS. **Spatial Data Types and Models:** Spatial Data types, Non-spatial / Attribute Data types, Tessellations to represent geographic objects, Data models: Basic Data Models –raster and vector, Spaghetti model and Topological model, Advanced data models, raster and vector data formats.			
Text Book	Text Book 1: Chapter 1		
MODULE-2	**Data Acquisition and Integration Techniques in Geospatial Information Management**	**22SCS324.2**	**8 Hours**
Primary and secondary methods of acquisition of spatial and non-spatial data: surveying, remote sensing, Photogrammetry, Global Navigation Satellite System (GNSS), Database creation, Data capturing, map scanning and digitizing, data exchange standards, topology building, editing and cleaning, linking of spatial and non-spatial data			
Text Book	Text Book 1: Chapters 7, 8 ,9, 11, 15 to 18		
MODULE-3	**Geospatial Data Processing, Quality Assurance, and Standards in GIS**	**22SCS324.3**	**8 Hours**
Data Processing: Hardware and software needed, Database Management Systems (DBMS), Linking GIS and DBMS, Raster and Vector data editing, data conversion, Corrections, scale changes, Coordinate thinning, Geo-referencing and map projections, sliver removal, edge matching, interactive editing, rubber sheeting. **Data Quality and Standards:** Definition of data quality, components of geographic data quality, Sources of error in geographic data, error propagation and error management; quality assurance & quality control (QA/QC). Geographic data standards, components and types of GIS standards, international GIS standards, interoperability of GIS			
Text Book	Text Book 1: Chapter 3, Text Book 2: Chapter 2		
MODULE-4	**Spatial Data Analysis and Integration & Visualization**	**22SCS324.4**	**8 Hours**
Spatial Data Analysis and Integration: Spatial Measurements, Queries, Vector Data Analysis, Raster Data Analysis, Network Analysis, Terrain analysis, spatial analysis of 3-Dimentional data, Data integration and map overlay. **Data Visualization:** GIS and Maps, Visualization process, visualization strategies, mapping qualitative and quantitative data, map / information dissemination.			
Text Book	Text Book 2: Chapter 3		
MODULE-5	**Advanced Spatial Data Analysis**	**22SCS324.4**	**8 Hours**
Advanced Spatial Data Analysis and Modelling: Trend surface analysis, Spatial interpolation, fuzzy analysis, GIS analytical models: Digital Terrain Models, Hydrologic modelling, Spatial Multi Criteria Analysis and engineering GIS applications, recent advances in GIS & Spatial Data Analytics (SDA), Career opportunities in GIS and SDA.			
Text Book	Text Book 2: Chapter 5, 7, 8. Text Book 3: Chapters 20		
Skill Development Activity	**Activity-1: Geocoding and Reverse Geocoding** **Objective:** Develop skills in converting addresses to geographic coordinates (geocoding) and vice versa. **Activity:** Use Google Maps Geocoding API to perform batch geocoding of addresses or locations. Geocode a dataset of addresses and visualize the results on a map. Then, reverse geocode coordinates to retrieve addresses and display them. **Activity-2: Spatial Analysis with Google Earth Engine:** **Objective:** Introduce advanced spatial analysis and remote sensing techniques. **Activity:** Use Google Earth Engine to perform spatial analysis tasks such as land cover classification, change detection, or time-series analysis. Script using Earth Engine's JavaScript API for geospatial analysis.		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)-SDA	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Concepts and Techniques of Geographic Information Systems, CP Lo Albert K W Yeung, 2005 Prantice Hall of India.
2. Principles of GIS for Land Resources Assessment by P.A.Burrough, Oxford: Science publications, 1986.
3. Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New York, 2002.

Reference Books:
1. GIS – A computing Perspective by Michael F. Worboys, Taylor & Francis, 1995.
2. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.
3. Geographical Information Systems – Principles and Applications, Volume I edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.
4. Geographical Information Systems – Principles and Applications, Volume II edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://biodesign.berkeley.edu/bioinspired-design-course/
- https://www.youtube.com/watch?v=cwxXY9Qe8ss
- https://www.youtube.com/watch?v=V2GvQXvjhLA
- https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design %20Workshop%20Report_2232327_October%202022_Final.508.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Geospatial Data Collection Field Trips:** Plan field trips where students collect geospatial data using GPS devices, mobile apps, and other tools. This hands-on experience helps them understand data acquisition and its challenges.
- **GIS Software Workshops:** Participate in workshops using popular GIS software like ArcGIS or QGIS. Students can learn how to create maps, perform spatial analyses, and work with real geospatial datasets.
- **Geospatial Data Visualization Projects:** Collaborate to create interactive maps and visualizations using online platforms like Mapbox or Leaflet. This encourages them to explore different ways of presenting geospatial data.
- **Spatial Analysis Case Studies:** Analyze real-world spatial problems and use GIS to find solutions. Work on projects related to urban planning, environmental monitoring, or disaster management.
- **GIS Modeling Projects:** Attend challenges to build geospatial models for predictive analysis. They can work on projects related to wildlife habitat modeling and use change prediction, or disease spread modeling.

BIOINFORMATICS			
Course Code	**22SCS325**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22SCS325.1	Gain insights into how biological knowledge can aid in tackling intricate computational challenges.
22SCS325.2	Explore genetic information and biological sequences, and employ various computational techniques to analyze DNA sequences.
22SCS325.3	Apply diverse algorithms to detect patterns in sequences, aiding in mutation identification and contributing to the advancement of disease discovery, a widespread societal issue.
22SCS325.4	Utilize Hidden Markov Models to analyze biological sequences, offering solutions for challenges within the healthcare industry.
22SCS325.5	Harness genetic algorithms for the identification and proposal of solutions to real-time issues with significant societal impact.
22SCS325.6	Employ neural networks and bio-inspired algorithms to investigate and resolve problems spanning various engineering sectors.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS325.1	3	3	3	-	-	-	-	-	1	1	-	2	3	3
22SCS325.2	3	3	3	-	-	-	-	-	1	1	-	2	3	3
22SCS325.3	3	3	3	-	-	-	-	-	1	1	-	2	3	3
22SCS325.4	3	3	3	-	-	-	-	-	1	1	-	2	3	3
22SCS325.5	3	3	3	-	-	-	-	-	1	1	-	2	3	3
22SCS325.6	3	3	3	-	-	-	-	-	1	1	-	2	3	3

MODULE-1	**BIOLOGICAL COMPUTATION**	**22SCS324.1**	**8 Hours**

Biological Introduction, Models and simulations, Exercises. Introduction to Python Language: Variables and predefined Functions, Developing Python code, Developing Python programs, Object-oriented programming, pre-defined classes and methods.

Text Book	Text Book 1: Chapter – 1, 2		
MODULE-2	**CELLULAR AND MOLECULAR BIOLOGY FUNDAMENTALS**	**22SCS324.2**	**8 Hours**

The Cell, The Genetic Information, Genes, Human Genome, Biological Resources and Databases.
Basic Processing of Biological Sequences, Exercises and programming Projects.

Text Book	Text Book 1: Chapter – 3		
MODULE-3	**PATTERN ANALYSIS**	**22SCS324.3**	**8 Hours**

Finding Patterns in Sequences, Exercises and Programming Projects. Hidden Markov Models, Exercises and Programming Projects.

Text Book	Text Book 2: 2, 5, 6,		
MODULE-4	**EVOLUTIONARY BIOLOGY AND EVOLUTIONARY COMPUTATION**	**22SCS324.4**	**8 Hours**

: Genetic Algorithms, Example Applications, Analysis of Behavior of Genetic Algorithms, Genetic Programming, A second look at the Evolutionary process. Exercises.

Text Book	Text Book 1: Chapter 4		
MODULE-5	**ARTIFICIAL NEURAL NETWORKS**	**22SCS324.4**	**8 Hours**

The perceptron, Learning in a multilayered network, Associative memory, Unsupervised learning, Exercises. Swarm Intelligence, Artificial Immune System, Artificial Life, Systems Biology.

Text Book	Text Book 1: Chapter 4, 5, Text Book 2: Chapter 7, 8
Skill Development Activity	**Activity-1: Sequence Alignment Practical:** **Objective:** Develop skills in sequence alignment techniques. **Activity:** For a given sequences (DNA, RNA, or protein), use the bioinformatics tools (like BLAST or Clustal Omega) to perform pair-wise or multiple sequence alignments. Interpret the alignment results and understand the sequence similarities. **Activity-2: Literature Review and Presentation:** **Objective:** Improve research and communication skills. **Activity:** Consider a bioinformatics-related research topic. Conduct a literature review, summarize key findings, and present a critical analysis of the study's methodology, results, and implications as a journal / conference paper.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)-SDA	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Lam, E., & Unger, R. (2011). "Biological Computation." CRC Press.
2. Rocha, M., & Ferreira, P. G. (Year). "Bioinformatics Algorithms: Design and Implementation in Python." Academic Press.

Reference Books:

1. Baldi, P., & Brunak, S. (Year). "Bioinformatics: The Machine Learning Approach" (2nd Edition). MIT Press.
2. Shortliffe, E. H., & Cimino, J. J. (Year). "Biomedical Informatics: Computer Applications in Healthcare and Biomedicine" (4th Edition). Springer.

Web links and Video Lectures (e-Resources):

- https://www.ncbi.nlm.nih.gov/
- https://www.ebi.ac.uk/
- https://www.uniprot.org/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Biological Database Development**: Design and develop a biological database for a specific research problem.

- **Case Studies in Precision Medicine**: Analyze case studies where bioinformatics plays a pivotal role in personalized medicine, cancer genomics, and pharmaco genomics.

- **Biomedical Literature Mining**: Use text-mining tools to extract information from scientific literature, focusing on gene-disease associations, drug interactions, and pathway analysis.

- **Bioinformatics Challenges and Competitions**: Participate in bioinformatics competitions and coding challenges to enhance their problem-solving skills.

PROJECT WORK PHASE-1			
Course Code	**22SCS34**	**CIE Marks**	**100**
L:T:P:S	**0:0:3:0**	**SEE Marks**	**--**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22SCS34.1	Comprehend the key principles and methodologies involved in project planning, including defining objectives, setting milestones, and creating timelines
22SCS34.2	Craft the comprehensive project proposals, encompassing clear problem statements, methodologies, expected outcomes, and resource requirements.
22SCS34.3	Apply appropriate research methodologies, including qualitative and quantitative methods, to address project objectives effectively
22SCS34.4	Develop proficient presentation skills for effectively communicating project proposals and research findings through clear, concise, and engaging oral and written presentations.
22SCS34.5	Critically evaluate project proposals, identifying strengths, weaknesses, and feasibility aspects, and apply feedback constructively to refine their work.
22SCS34.6	Apply all ethical considerations in project planning and research, emphasizing integrity, professionalism, and the ethical implications of their proposed projects

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS34.1	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS34.2	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS34.3	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS34.4	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS34.5	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS34.6	-	-	-	-	3	3	3	3	3	3	3	-	-	3

Project Phase-1 Roadmap: Guiding Principles and Description

The Project Work typically consists of two phases: Phase 1 and Phase 2. Phase 1 focuses on initial planning and groundwork for the research project, and it often includes a paper presentation. Here is a description of what Phase 1, including the paper presentation and publication, typically entails:

Phase 1: Project Planning, Proposal, and Paper Presentation

- **Project Selection**: In Phase 1, students select a research project topic within the domain of computer science and engineering. The selection should align with the student's interests and the expertise of the faculty mentor.

- **Literature Review**: Students conduct a comprehensive literature review to understand the existing research in the chosen area. This review helps in identifying gaps and opportunities for contributing new knowledge.

- **Problem Statement**: Based on the literature review, students define a clear and well-structured problem statement or research question that their project aims to address.

- **Objectives**: Students outline the specific objectives they intend to achieve during the course of the project. These objectives should be aligned with the problem statement and research goals.

- **Methodology**: A description of the research methodology and techniques to be used in the project. Students need to explain how they plan to collect data, conduct experiments, or perform simulations.

- **Work Plan**: Create a detailed work plan or timeline that outlines the tasks, activities, and milestones for the entire project. This helps in managing the project efficiently.

- **Project Proposal**: Prepare a formal project proposal that includes an introduction to the research area, the problem statement, objectives, literature review, methodology, and a clear plan for Phase 2. This proposal will be submitted for approval by the faculty mentor and the department.

- **Ethical Considerations**: Address any ethical considerations relevant to the research, especially if it involves human subjects, data privacy, or other sensitive issues.

- **Resources and Budget**: Identify the resources, software, hardware, and funding requirements for the project. Discuss how you plan to secure these resources.

- **Risk Assessment**: Identify potential risks and challenges that may arise during the project and provide strategies for mitigating them.

- **Mentor Selection**: Students should identify a faculty mentor who will guide and supervise the project. The mentor plays a critical role in the successful completion of the research.

- **Paper presentation and Journal publication**: As part of Phase 1, students may be required to present a paper or research proposal to their faculty mentors and peers. This presentation serves as a formal introduction to the research and provides an opportunity for feedback. **The outcome of Phase 1 of the project, it is mandatory to publish a research paper in a Scopus-indexed journal.**

- **Project Approval**: After preparing the project proposal and completing the paper presentation, it needs to be submitted to the department or institution for formal approval.

Phase 1 sets the foundation for the entire research project, providing a clear direction and plan for Phase 2. The paper presentation is an essential component of Phase 1, as it allows students to communicate their research ideas, receive feedback, and refine their project proposals based on the input from faculty mentors and peers. Successful completion of Phase 1 ensures that students are well-prepared to start the practical research and implementation work in Phase 2. It is essential for students to maintain regular communication with their faculty mentor throughout Phase 1 and beyond.

CIE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Periodical Reviews & Evaluation
		50
L1	Remember	5
L2	Understand	5
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SEE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

Web links and Video Lectures (e-Resources):

- GitHub: GitHub is a platform for software development that hosts millions of open-source projects. You can explore projects, read their documentation, and gain insights into various software development ideas and practices. https://github.com/
- Dev.to: Dev.to is a community-driven platform for developers. It features articles, discussions, and posts on various software development ideas, best practices, and emerging trends. https://dev.to/
- HackerRank Blog: Hacker Rank's blog contains articles and insights on coding challenges, data structures, algorithms, and software development topics. https://www.hackerrank.com/blog
- Medium: Medium is a platform where many software developers share their thoughts, experiences, and project ideas. You can find a wide range of articles on software development. https://medium.com/
- edX: edX offers video courses on software development, including topics like web development, mobile app development, and more. https://www.edx.org/
- Coursera: Coursera hosts video lectures and courses on a variety of software development subjects. You can explore courses from top universities and institutions. https://www.coursera.org/
- MIT OpenCourseWare: MIT provides free access to video lectures and course materials on computer science and software development. You can find lectures on various programming concepts and project ideas. https://ocw.mit.edu/index.htm
- Google Developers YouTube Channel: Google Developers offers video content on various software development topics, including APIs, web development, and mobile app development. https://www.youtube.com/user/GoogleDevelopers

<table>
<tr><td colspan="5" align="center">SOCIETAL PROJECT</td></tr>
</table>

Course Code	**22SCS35**	**CIE Marks**	**100**
L:T:P:S	0:0:3:0	**SEE Marks**	--
Hrs / Week	3	**Total Marks**	**100**
Credits	03	**Exam Hours**	03

Course outcomes:

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

22SCS35.1	Identify key terminology, concepts, and theories in environmental sustainability
22SCS35.2	Interpret complex environmental data to comprehend patterns and trends
22SCS35.3	Apply various environmental assessment methods and tools to analyze and evaluate environmental issues.
22SCS35.4	Analyze the interconnections between societal, economic, and environmental factors influencing sustainable development.
22SCS35.5	Critically assess the ethical implications and social responsibilities associated with environmental engineering projects
22SCS35.6	Devise innovative and sustainable solutions to address complex environmental problems

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS35.1	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS35.2	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS35.3	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS35.4	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS35.5	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS35.6	-	-	-	-	3	3	3	3	3	3	3	-	-	3

Societal Project Roadmap: Guiding Principles and Description

A societal project typically involves research or practical work that addresses a specific societal or community issue using computer science and engineering principles and technologies. These projects aim to make a positive impact on society, and they often have real-world applications.

Project Selection: Choose a project topic that addresses a societal challenge, such as healthcare, education, environment, or local community issues. The project should align with the broader goal of contributing to the betterment of society.

Problem Definition: Clearly define the problem you intend to solve or the societal issue you want to address. This should be well-researched and based on an understanding of the specific needs of the community or society.

Literature Review: Conduct a thorough literature review to understand existing research and solutions related to the chosen societal problem. Identify gaps and areas where your project can make a meaningful contribution.

Project Planning: Create a detailed project plan that includes objectives, tasks, milestones, and a timeline. Consider the resources and funding required for the project.

Mentor Selection: Identify a faculty mentor who specializes in the chosen area and can provide guidance throughout the project.

Data Collection and Analysis: If the project involves data, conduct surveys, gather information, or use

existing datasets to support your research. Analyze the data to draw insights and inform your solution.

Solution Development: Design and develop a technological solution or system that addresses the societal problem. This could involve software development, hardware design, or a combination of both.

Testing and Validation: Thoroughly test and validate your solution to ensure it meets the requirements and effectively addresses the societal issue.

Community Engagement: If applicable, engage with the community or stakeholders affected by the problem. Gather feedback and insights to refine your solution.

Documentation: Keep detailed records of your project activities, methodologies, and results. Proper documentation is crucial for transparency and knowledge sharing.

Paper or Report: Write a comprehensive project report or research paper that documents the problem, methodology, findings, and the societal impact of your project.

Presentation: Present your project findings and outcomes to faculty, peers, and possibly the community or relevant stakeholders. This presentation should highlight the societal relevance and impact of your work.

Feedback and Revisions: Address any feedback or suggestions provided by your mentor or evaluation committee. Make revisions as needed.

Community Implementation: If your project solution is practical and ready for implementation, work with the community or relevant organizations to put it into action.

Evaluation and Assessment: Your project will be assessed based on its societal impact, innovation, and contribution to solving the identified problem.

Societal projects offer students the opportunity to leverage their technical skills and knowledge to address real-world issues, making a positive difference in society. These projects are often interdisciplinary and may involve collaboration with experts from various fields, emphasizing the practical application of computer science and engineering in solving societal challenges.

CIE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Periodical Reviews & Evaluation
		50
L1	Remember	5
L2	Understand	5
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SEE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

INTERNSHIP				
Course Code	**22SCSI36**	**CIE Marks**	**50**	
L:T:P:S	**0:0:6:0**	**SEE Marks**	**50**	
Hrs / Week	**3**	**Total Marks**	**100**	
Credits	**06**	**Exam Hours**	**03**	

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

22SCSI36.1	Apply theoretical concepts and technical knowledge gained during the academic program to solve real-world problems in a professional setting within the field of computer science and engineering.
22SCSI36.2	Demonstrate the ability to plan, execute, and manage a project by applying project management methodologies, software development life cycles, or research protocols as relevant to the internship project.
22SCSI36.3	Develop and implement innovative solutions to technical challenges encountered during the internship, showcasing adaptability, critical thinking, and troubleshooting abilities.
22SCSI36.4	Engage in effective communication with team members, supervisors, and stakeholders, demonstrating the ability to collaborate within multidisciplinary teams and present ideas coherently.
22SCSI36.5	Exhibit professional ethics and adaptability to diverse work environments, adhering to industry standards, practices, and ethical guidelines while navigating the challenges of a professional setting
22SCSI36.6	Reflect on the internship experience, evaluate personal growth, and integrate the practical insights gained into academic coursework, fostering a connection between theory and real-world application

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCSI36.1	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCSI36.2	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCSI36.3	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCSI36.4	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCSI36.5	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCSI36.6	-	-	-	-	3	3	3	3	3	3	3	-	-	3

Detailed Description and Guideline

Internship (6 weeks Internship completed during the intervening vacation of II & III semesters.)

Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Periodical Reviews & Evaluation
		50
L1	**Remember**	5
L2	**Understand**	5
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	10

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

Fourth Semester Syllabus

PROJECT WORK PHASE-2													
Course Code	**22SCS41**						**CIE Marks**			**100**			
L:T:P:S	**0:0:18:0**						**SEE Marks**			**100**			
Hrs / Week	**3**						**Total Marks**			**200**			
Credits	**18**						**Exam Hours**			**03**			

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

22SCS41.1	Demonstrate proficiency in advancing the project initiated in Phase-1, showcasing enhanced development, implementation, and refinement of the project solution.
22SCS41.2	Apply innovative problem-solving methodologies to address complex technical challenges encountered during the project's advancement, showcasing adaptability and creativity.
22SCS41.3	Integrate advanced technologies, tools, or frameworks within the CSE domain to augment the project's functionalities or performance, demonstrating technical prowess and innovation
22SCS41.4	Conduct critical analysis and evaluation of project methodologies, algorithms, or implementations, demonstrating the ability to assess and justify the chosen approaches effectively.
22SCS41.5	Produce comprehensive documentation, technical reports, or research papers detailing the advanced stages of the project, including methodologies, experimental results, modifications made, and their impact.
22SCS41.6	Deliver a professional-level presentation or defense, effectively communicating the project's progress, advancements, technical intricacies, outcomes, and contributions to peers, faculty, and evaluators.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SCS41.1	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS41.2	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS41.3	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS41.4	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS41.5	-	-	-	-	3	3	3	3	3	3	3	-	-	3
22SCS41.6	-	-	-	-	3	3	3	3	3	3	3	-	-	3

Project Work Phase-2: Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1 to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the Institution norms.

Phase 2: Project Implementation and Documentation

1. **Implementation**: During this phase, students implement the research project based on the plan and objectives outlined in Phase 1. This may involve software development, data collection, experiments, simulations, or other research activities, depending on the nature of the project.

2. **Experimentation and Data Collection**: If the project involves experimental research or data collection, students conduct the necessary experiments or collect data systematically. This may include setting up test environments, conducting surveys, or working with datasets.

3. **Software Development**: If the project involves software development, students write, test, and refine the code or software application as per the project's requirements.

4. **Data Analysis and Evaluation**: Analyze the collected data or results, applying appropriate statistical or computational techniques. Evaluate the outcomes against the defined objectives.

5. **Documentation**: Maintain detailed records of all project activities, including the code, datasets, experiments, and results. Proper documentation is crucial for transparency and reproducibility.

6. **Intermediate Reports**: Submit intermediate progress reports to the faculty mentor, highlighting the achievements, challenges, and modifications made during the implementation phase.

7. **Regular Meetings**: Maintain regular communication with the faculty mentor through meetings, emails, or online discussions to seek guidance and address any issues that may arise during the project.

8. **Problem-Solving**: Tackle any problems or deviations from the plan as they occur and implement solutions effectively.

9. **Testing and Validation**: If the project involves a software application or system, perform rigorous testing and validation to ensure that it meets the defined requirements.

10. **Final Deliverables**: Prepare the final deliverables, which may include a research paper, project report, software documentation, user manuals, and any other artifacts.

11. **Thesis or Dissertation**: If required, write the master's thesis or dissertation, which presents the research, methodology, findings, and contributions.

12. **Presentation**: Prepare and deliver a final project presentation, which may include a public seminar or defense before faculty and peers.

13. **Submission and Evaluation**: Submit the final project report, thesis, or dissertation for evaluation and assessment. It will be reviewed by a committee of faculty members.

14. **Viva Voce**: Appear for a viva voce (oral examination) to defend the project work and explain the research, methodology, and findings to the evaluating committee.

15. **Feedback and Revisions**: Address any feedback or revisions suggested by the evaluating committee.

16. **Final Approval**: After successfully completing Phase 2 and fulfilling all project requirements, the project will be formally approved, and the degree is awarded upon successful defense.

CIE Assessment Pattern (50 Marks – Lab)		
RBT Levels		**Periodical Reviews & Evaluation**
		50
L1	**Remember**	5
L2	**Understand**	5
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	10

SEE Assessment Pattern (50 Marks – Lab)		
RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	5
L2	**Understand**	5
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	10

BOS RECOMMENDED ONLINE COURSE			
Course Code	**22MOOC2**	**CIE Marks**	**--**
L:T:P:S	0:0:0:0	**SEE Marks**	**--**
Hrs / Week	--	**Total Marks**	PP
Credits	--	**Exam Hours**	**--**

These guidelines ensure that the recommended online courses complement and enrich the M.Tech program, providing students with a comprehensive and updated understanding of the subject matter while fostering skills essential for their professional development in the field of Computer Science and Engineering.

1. **Relevance to Curriculum:** Courses supplement the core curriculum, filling gaps or providing deeper insights into subjects covered in the program.
2. **Quality and Credibility:** Online courses from reputable platforms or institutions, offering high-quality content, credible instructors, and recognized certifications upon completion.
3. **Alignment with Learning Outcomes:** Courses are aligned with the program's learning outcomes, focusing on skill development, knowledge enhancement, or practical application relevant to the field of study.
4. **Flexibility and Accessibility:** Consideration for the flexibility of online courses to accommodate students' schedules and accessibility across different learning environments, ensuring inclusivity.
5. **Emerging Trends and Technologies:** Courses may emphasize emerging trends, new technologies, or innovative methodologies relevant to the field of study, keeping students updated with industry advancements.
6. **Interactive and Engaging Content:** Preference for courses with interactive elements, practical exercises, case studies, or projects that engage students actively in the learning process.
7. **Feedback and Evaluation:** Regular assessment of the effectiveness of recommended courses based on student feedback, course completion rates, and the application of learning outcomes in academic or practical contexts.
8. **Adaptability and Evolution:** Recognition of the dynamic nature of technology and learning, encouraging the inclusion of courses that adapt to evolve with industry standards and educational methodologies.

Appendix A: List of Assessment Patterns

S.NO	Pattern of Assessments
1	Assignments
2	Group Discussions
3	Case Study / Caselets
4	Practical-Orientation on Design Thinking
5	Participatory & Industry-Integrated Learning
6	Practical Activities / Problem Solving Exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / Workshops
12	Any Other Academic Activity
13	Online / Offline Quizzes

APPENDIX B: Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes

COURSE OUTCOME
↓
PROGGRAM OUTCOME
↓
PROGRAM EDUCATIONAL OBJECTIVES
↓
DEPARTMENTAL MISSION
↓
DEPARTMENTAL VISION
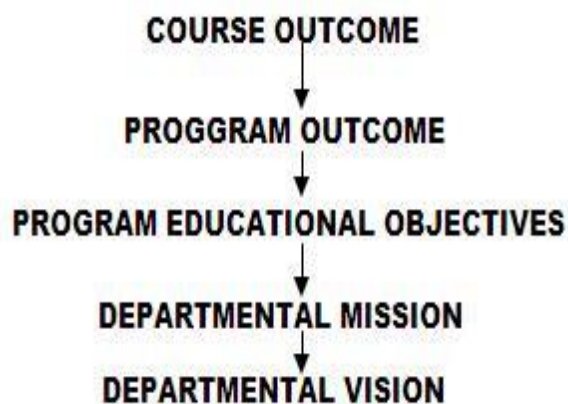
APPENDIX C: The Graduate Attributes of NBA

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

Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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.

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.

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

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

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.

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 leader in a team, to manage projects and in multidisciplinary environments.

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.

APPENDIX D: BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.

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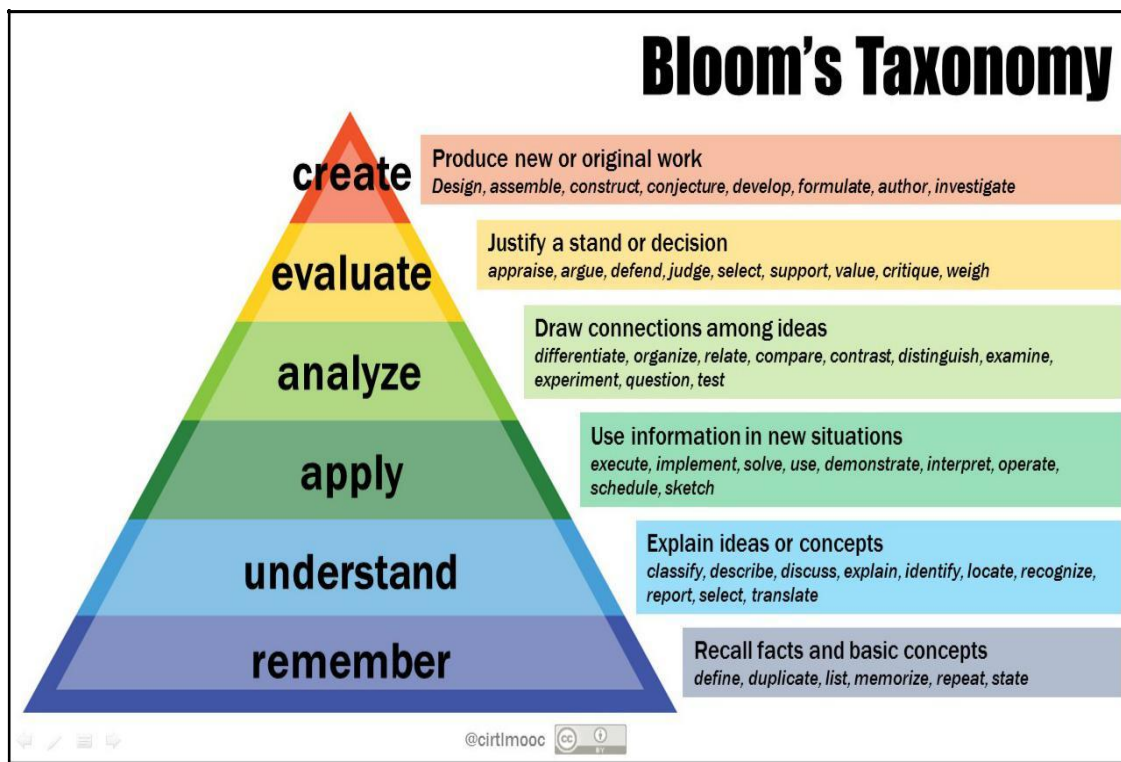
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F o l l o w   u s