NEW HORIZON
COLLEGE OF ENGINEERING

SILVER HORIZONS
25 YEARS OF GLOBAL LEARNING

Department of Computer Science and Engineering

Academic Year
2025-26

M.Tech (CSE) 3rd and 4th Semester
Scheme & Syllabus 2025-26
BATCH: 2024-26
CREDITS: 80

Department of Computer Science and Engineering

Academic Year 2025-26

M.Tech (CSE) 3rd & 4th Semester Scheme & Syllabus

BATCH: 2024-26

CREDITS: 80

*****

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 ComputerScience 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, societal and environmental considerations.

PO4: 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.

PO5: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO6: 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 for 2024 - 2026 BATCH (2024 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	24SCS31	Advanced Computer Network & Security	CSE	3	0	0	1	4	5	50	50	100
2	PEC/CSE	24SCS32X	Professional Elective – III	CSE	3	0	0	0	3	3	50	50	100
3	OEC/DEP	24NHOPGXX	Open Elective Courses	CSE	3	0	0	0	3	3	50	50	100
4	PROJ/CSE	24SCS34	Project Work Phase – 1	CSE	0	0	3	0	3	-	100	--	100
5	SP/CSE	24SCS35	Societal Project	CSE	0	0	3	0	3	-	100	--	100
6	INT/CSE	24SCSI36	Internship	CSE	0	0	0	6	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 – Tutorial and **S**- Skill Development Activities (Hours are for Interaction between faculty and students). **Internship** - (6 weeks Internship completed during the intervening vacation of II & III semesters.)

Professional Elective – III	
Course Code	**Course Title**
24SCS321	Prompt Engineering
24SCS322	Distributed Computing
24SCS323	Crime Detection and Forensics
24SCS324	High Performance Computing
24SCS325	Service Oriented Architecture

24NHOPGXX – Open Elective Courses			
24NHOPG01	Data Analytics using R Programming	24NHOPG07	Physical Design
24NHOPG02	Robotic Process Automation	24NHOPG08	Programming of Industrial Robot
24NHOPG03	Juniper Routing and Switching	24NHOPG09	5G Communication
24NHOPG04	Blockchain	24NHOPG10	SAP
24NHOPG05	Schneider - Industrial Automation	24NHOPG11	Product Life Cycle Management
24NHOPG06	Cisco Routing & Switching	24NHOPG12	Industry 4.0

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 for 2024 - 2026 BATCH (2024 Scheme)

S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
IV – Semester													
					L	T	P	S			CIE	SEE	Total
1	Project/ CSE	24SCS41	Project Work Phase – 2	CSE	0	0	20	0	20	-	100	100	200
2	AUD/AEC	24MOOC2	BOS Recommended Online Courses	CSE	Classes and evaluation procedures are as per the policy of the on line course providers.								PP
Total									**20**	**-**	**100**	**100**	**200**

Note:

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 -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.

Third Semester Syllabus

ADVANCED COMPUTER NETWORK & SECURITY				
Course Code	**24SCS31**	**CIE Marks**	**50**	
L:T:P:S	**3:0:0:1**	**SEE Marks**	**50**	
Hrs / Week	**5**	**Total Marks**	**100**	
Credits	**04**	**Exam Hours**	**03**	

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

24SCS31.1	Reflect on the hurdles in networking, specifically differentiating between the TCP/IP and the 7-Layer OSI model.
24SCS31.2	Categorize various routing protocols for a range of applications.
24SCS31.3	Apply various wireless networks, including ad-hoc networks with their associated protocols.
24SCS31.4	Assess different switching protocols.
24SCS31.5	Investigate protocols used in wide area networks and their practical, real-time applications.
24SCS31.6	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	PS01	PSO2
24SCS31.1	3	3	-	-	1	-	3	-
24SCS31.2	3	3	3	2	2	-	3	-
24SCS31.3	3	3	-	2	3	-	3	-
24SCS31.4	3	3	3	-	3	-	3	-
24SCS31.5	3	3	3	-	3	-	3	-
24SCS31.6	3	3	-	-	3	-	3	-

MODULE-1	**COMPUTER NETWORKS AND MODELS**	**24SCS31.1**	**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**	**24SCS31.2**	**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**	**24SCS31.3, 24SCS31.4**	**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**	**24SCS31.5**	**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	24SCS31.6	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. Create a simple network with two PCs and one switch in **Cisco Packet Tracer**. Assign IP addresses to both PCs and verify network connectivity using the ping command. 2. In **Cisco Packet Tracer**, configure two VLANs (VLAN10 and VLAN20) on a switch. Assign PCs to each VLAN and test communication between PCs within and across VLANs. 3. Connect two routers and two separate LANs in **Cisco Packet Tracer**. Configure static routing on both routers so that PCs in different LANs can communicate. Verify using ping. 4. Set up a **DHCP Server** in **Cisco Packet Tracer** to assign IP addresses automatically to PCs in a network. Verify dynamic IP allocation using the simulation mode. 5. Use **Wireshark** to capture packets while performing a ping between two devices. Analyze the captured packets and identify the ICMP Echo Request and Echo Reply messages. 6. Using **Wireshark**, capture packets during a TCP connection (e.g., opening a website or connecting to a service). Identify and explain the **three-way handshake** process (SYN, SYN-ACK, ACK). **Online Certification Course** https://spoken-tutorial.org/tutorial-search/?search_foss=ns-3+Network+Simulator&search_language=

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		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. ISBN-10: **0073376221**
2. Alberto Leon Garcia & Indra : Communication Networks – Fundamental Concepts & key architectures, 2nd Edition Tata McGraw-Hill (New Delhi), 2004 ISBN-0070595011

Reference Books:
1. C. Siva Ram Murthy, B. S. Manoj,Ad Hoc Wireless Networks,1st Pearson Education ISBN-10: 013147023X
2. Atul Kahate, Cryptography and Network Security, 4th Edition, 2019, ISBN-10: 9353163315
3. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley India, 2011, ISBN-10: 8126533692

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 – III	
Course Code	**Course Title**
24SCS321	Prompt Engineering
24SCS322	Distributed Computing
24SCS323	Crime Detection and Forensics
24SCS324	High Performance Computing
24SCS325	Service Oriented Architecture

PROMPT ENGINEERING				
Course Code	24SCS321	**CIE Marks**	50	
L:T:P:S	3:0:0:0	**SEE Marks**	50	
Hrs / Week	03	**Total Marks**	100	
Credits	03	**Exam Hours**	03	

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

24SCS321.1	Understand the importance and benefits of prompt engineering
24SCS321.2	Apply the techniques involved and monitor the prompt for Generative AI
24SCS321.3	Compute the functions and feedback for ChatGPT prompt
24SCS321.4	Identify the framework to find out the Quality prompt
24SCS321.5	Analyze the effective output for the quality prompt
24SCS321.6	Evaluate the various advanced prompt engineering techniques

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

	PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2
24SCS321.1	3	-	2	-	1	3	-	-
24SCS321.2	3	2	3	2	2	-	2	-
24SCS321.3	3	3	3	3	3	-	2	-
24SCS321.4	3	2	3	3	3	-	3	-
24SCS321.5	3	3	3	3	3	-	1	-
24SCS321.6	3	3	3	3	3	-	1	2

MODULE-1	**INTRODUCTION TO PROMPT ENGINEERING**	24SCS321.1	8 Hours
Prompts- Types of Prompts – works of prompt engineering – Evaluating and validating prompts - Role of prompts in AI models – Importance of effective prompts – Techniques in Prompt engineering - Ethical considerations in prompt engineering– Benefits in prompt engineering.			
Self-study / Case Study / Applications	Case Study on Virtual Education Platform Using Prompt		
Text Book	Text Book 1: Chapter 1,2		
MODULE-2	**PROMPT ENGINEERING-GENERATIVE AI**	24SCS321.2	8 Hours
Generative language models- NLP and ML foundations, common NLP task, Optimizing prompt-based models, Tuning and optimization techniques, Pre-training and transfer learning – Designing effective prompts – prompt generation strategies – Monitoring prompt effectiveness.			
Self-study / Case Study / Applications	Case study on Generative AI for Assisting Visual Disabled Persons		
Text Book	Text Book 1: Chapter 4,5		
MODULE-3	**CHATGPT**	24SCS321.3	8 Hours
Reinforcement Learning from Human Feedback- The Process of Building a Model- Moving from Instruct GPT to ChatGPT- Instruct GPT- ChatGPT- The Changing API- Chat Completion API- Moving Away from Chat-Moving Beyond Chat to Functions- Prompt Engineering as Play Writing.			
Self-study / Case Study / Applications	Case study on Dynamic Prompt Engineering for Real-Time Language Translation in Multilingual Support		
Text Book	Text Book 1: Chapter 6,7		
MODULE-4	**A FRAMEWORK FOR EFFECTIVE AI COMMUNICATION**	24SCS321.4, 24SCS321.5	8 Hours

The CLEAR Framework - Concise and Logical Prompt Crafting - Explicit Prompt Crafting - Adaptive Prompt Crafting - Reflective Prompt Crafting - The Relationship Between Prompts and Outputs - Quality Prompts – A Systematic Approach.

Self-study / Case Study / Applications	Case Study on Real-Time Prompt Engineering in AI for Smart Farming		
Text Book	Text Book 1: Chapter 8,9		
MODULE-5	**ADVANCED PROMPT ENGINEERING**	**24SCS321.6**	**8 Hours**

Chain-of-Thought (CoT) Prompting, Tree-of-Thoughts (ToT) Prompting, Active prompting, Reason and Act(ReAct), Expert Prompting, Automatic Prompt Engineering (APE).

Self-study / Case Study / Applications	Case Study on Fraud Detection in Banking System
Text Book	Text Book 1: Chapter 11

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
	RBT Levels	**Test (s)**	**AAT1**	**AAT2**
		25	**15**	**10**
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	5	7.5	-
L4	Analyze	5	7.5	-
L5	Evaluate	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:
 Textbooks:
1) Prompt Engineering for Generative AI, by James Phoenix, Mike Taylor, Published by O'Reilly   Media,Inc. in 2024, ISBN: 9781098153434
Reference Books:
1) The Art of Prompt Engineering with ChatGPT: A Hands-On Guide: 3 (Learn AI Tools the Fun Way!) by Nathan Hunter published in 2023. ISBN: 9781739296728
2) What Is ChatGPT Doing ... and Why Does It Work? Paperback by Stephen Wolfram in 2023. ISBN:9781579550813
3) Prompt Engineering: The Art of Asking Hardcover by Yaswanth Sai Palaghat in 2023. ISBN: 9798890673169

Web links and Video Lectures (e-Resources):
- **https://www.youtube.com/watch?v=mnULGqkVONI**
- **https://youtu.be/jC4v5AS4RIM**
- **https://www.youtube.com/watch?v=QZosTTcg7F8&pp=ygUZcHJvbXB0IGV**
- **https://www.youtube.com/watch?v=1afc2cAz2Tg&list=PL9ooVrP1hQOE5dmqWrYQqQTX-FFyfYdLf**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
• Video demonstration of latest trends in Generative AI • Demonstration of sample projects done using ChatGPT • Contents related activities (Activity-based discussions) • For active participation of students, instruct the students to prepare quality prompts and Handouts • Organizing Group wise discussions on issues

DISTRIBUTED COMPUTING

Course Code	24SCS322		CIE Marks	50
L:T:P:S	3:0:0:0		SEE Marks	50
Hrs / Week	3		Total Marks	100
Credits	3		Exam Hours	03

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

24SCS322.1	Explore the system models in distributed system
24SCS322.2	Apply various communication models in distributed system
24SCS322.3	Investigate the issues in peer-to-peer services
24SCS322.4	Explore distributed file systems
24SCS322.5	Analyze synchronization and replication algorithms in distributed system
24SCS322.6	Apply resource management algorithms for load balancing

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

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
24SCS322.1	3	2	-	3	-	-	2	3
24SCS322.2	3	2	-	3	-	-	2	3
24SCS322.3	3	2	-	3	-	-	2	3
24SCS322.4	3	2	-	3	-	-	2	3
24SCS322.5	3	2	-	3	-	-	2	3
24SCS322.6	3	2	-	3	-	-	2	3

MODULE-1	INTRODUCTION	24SCS322.1	8 Hours

Introduction–Examples of distributed systems–Trends in distributed systems–Focus on resource sharing–Challenges–World Wide Web–System models–Physical models–Architectural models–Fundamental models

Text Book: T1: Chapter 1,2

MODULE-2	COMMUNICATION IN DISTRIBUTED SYSTEM	24SCS322.2	8 Hours

Inter Process Communication–The API for the Internet protocols–External data representation–Multicast Communication – Network virtualization: Overlay networks. MPI – Request–reply protocols – Remote procedure call. Distributed Objects: Java RMI –Group communication –Publish–subscribe systems –Message queues –Shared memory approaches – From Objects to Components: Enterprise Java Beans

Text Book: T1: Chapter 4,5,6,8

MODULE-3	PEER TO PEER SYSTEMS AND DISTRIBUTED FILESYSTEMS	24SCS322.3 & 24SCS322.4	8 Hours

Introduction–Napster and its legacy–Peer–to–peer Middleware –Routing overlays– Overlay case studies: Pastry, Tapestry. Distributed File Systems –File service architecture –Sun Network File System–Google File System – Name Services and Domain Name System – Directory services – Case studies: The Global Name System, X.500 Directory Service

Text Book: T1: Chapter 10,12,13

MODULE-4	SYNCHRONIZATION AND FAULT TOLERANCE	24SCS322.5	8 Hours

Introduction–Clocks, events and process states–Synchronizing physical clocks–Logical time and logical clocks–Global states – Coordination and Agreement – Distributed mutual exclusion – Elections –Transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic commit protocols – Concurrency control in distributed systems – Distributed deadlocks

Text Book: T1: Chapter 14,15,16,17

MODULE-5	RESOURCE AND PROCESS MANAGEMENT	24SCS322.6	8 Hours

Resource management: Desirable features of a good global scheduling algorithm–Task assignment approach–Load balancing approach–Load sharing approach–Process management: Process migration–Threads

Text Book: T2: chapter 9,10

CIE Assessment Pattern (50 Marks)			
		Marks Distribution	
RBT Levels	Test (s)	AAT1	AAT2
	25	**15**	**10**
L1	Remember	-	-	-
L2	Understand	5	5	-
L3	Apply	10	3	5
L4	Analyze	10	2	5
L5	Evaluate	-	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education,2017 ISBN-10. 9789332575226
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India,2021 ISBN-13: 9780780311190

Reference Books:

1. Tanenbaum A.S., VanSteen M., "Distributed Systems: Principles and Paradigms", Pearson Education,2021 ISBN-13: 978-1530281756
2. LiuM.L.," Distributed Computing, Principles and Applications", Pearson Education,2022 ISBN10 0201796449
3. Nancy ALynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA,2023 ISBN: 9788178672403
4. Mukesh Singhal and Niranjan G.Shivaratri,"Advanced Concepts in Operating Systems–Distributed, Database, and Multiprocessor Operating Systems", TataMcGraw–Hill,2021 ISBN-10. 0070472688

CRIME DETECTION AND FORENSICS				
Course Code	24SCS323		**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:

24SCS323.1	Understand the basics of digital forensics and crime detection techniques.
24SCS323.2	Analyse the various causes and types of crimes and criminals.
24SCS323.3	Investigate real-world cybercrime cases and understand legal frameworks.
24SCS323.4	Apply the various tools and technologies used in forensic investigation.
24SCS323.5	Examine the skills for handling digital evidence in a legally sound manner.
24SCS323.6	Evaluate emerging trends and ethical concerns in forensic science.

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
24SCS323.1	3	-	-	-	-	-	2	-
24SCS323.2	3	3	-	2	-	-	2	-
24SCS323.3	3	3	-	2	-	-	2	-
24SCS323.4	3	3	-	-	-	-	2	-
24SCS323.5	3	3	-	2	-	-	2	-
24SCS323.6	3	3	-	2	-	-	2	-

MODULE-1	**Introduction to Crime and Forensic**	24SCS323.1	8 Hours

Crime: definition, characteristics of crime, elements of crime, and crime triangle; Criminology – definitions, historical perspectives, nature, origin, and scope, Crime Classification: Cybercrime vs Conventional Crime, Role of Forensics in Modern Investigations, Overview of Forensic Science and Criminal Justice Systems, Evolution of Cyber Laws: IT Act 2000, IPC Sections Relevant to Cybercrime, Jurisdiction, Digital Rights, and Privacy Challenges.

Case Study/ Self-study	1. An individual steals credit card details online and uses them to make purchases. Separately, another individual snatches a woman's purse in a crowded market. **Questions:** Compare the two cases in terms of methods, detection, and jurisdiction. What are the challenges in investigating the cybercrime case compared to the conventional one? Discuss how intent and execution differ in both types of crime. **2.** A startup's internal data is breached due to phishing. The attacker uses servers located abroad. **Questions:** Which sections of the IT Act 2000 and IPC are applicable here? How does the IT Act address cross-border jurisdiction issues? Suggest legal and technical steps the company should take post-breach.
Text Book	Text Book 1: chapter 1,2,3
MODULE-2	**Causes and Types of Crime and Criminals** 24SCS323.2 8 Hours

Causes of crime: Social, Economic, Political and Psychological; Social Problems and crime: Juvenile Delinquency, Prostitution, Dowry, drug abuse, and child labor. Types of Crime: Crimes against persons, violent crimes, sexual offences, crimes against property, cyber-crime, hate crimes and public disorder, emerging crimes. Types of Criminals: Habitual, Professional and White-Collar criminals.

Case Study/ Self-study	1. A 16-year-old is caught shoplifting electronics. He has dropped out of school and has no parental supervision. **Questions:** What social conditions are contributing to his delinquency? How should the juvenile justice system respond—rehabilitation or punishment. Suggest community-based preventive

	strategies. 2. Children are found working in a fireworks factory under hazardous conditions. **Questions:** What legal frameworks prohibit child labor in India? How are economic pressures and poverty linked to this crime? Suggest long-term rehabilitation plans for rescued children.		
Text Book	Text Book 1: Chapter 11,12,13		
MODULE-3	**Digital Forensics, Evidence and Crime Scene Investigation**	**24SCS323.3**	**8 Hours**
Introduction: Digital Forensic Principles, Digital Environments, Digital Forensic Methodologies, Media Analysis, Types and Sources of Digital Evidence**,** Identification, Preservation, and Collection of Evidence**,** Chain of Custody and Documentation**,** Digital Crime Scene Procedures**,** Legal Considerations in Evidence Handling
Case Study/ Self Study	1.A digital forensic examiner is tasked with investigating a corporate espionage case. They must maintain forensic soundness and ensure that the evidence is not altered during the process. **Questions:** What are the core principles of digital forensics the examiner should follow? How does the principle of repeatability and integrity apply in this scenario? What could invalidate the evidence in court? 2.An investigation involves retrieving deleted data from a cloud storage platform and a smartphone used by the suspect. **Questions:** What types of digital environments are involved in this case? How does the forensic approach differ for cloud-based versus mobile device evidence? Discuss potential limitations of accessing data in these environments.		
Text Book	Text Book 2: Chapter 2, Textbook 3: Chapter 4, Textbook 4: Chapter 6		
MODULE-4	**Digital Forensics Tools and Techniques**	**24SCS323.4**	**8 Hours**
Disk Imaging and Recovery Tools (FTK Imager, Autopsy), File System Forensics (FAT, NTFS, EXT), Email, Log, and Browser Forensics, Mobile Device Forensics, Steganography and Anti-Forensics Techniques.
Case Study/ Application	1.A USB flash drive formatted in FAT32 and a laptop running Linux (EXT4 file system) are both suspected of storing illegal files. **Questions:** Compare FAT32, NTFS, and EXT file systems in terms of forensic analysis capabilities. What artifacts or metadata might you extract from NTFS and EXT that FAT lacks? How do features like journaling and timestamps support or hinder forensic timelines? 2.A phishing email was used to trick a company employee into downloading a malicious attachment. Investigators must trace the source of the email and browser activity surrounding the incident. **Questions:** How would you conduct email header analysis to trace the sender? What types of browser artifacts (e.g., cache, history, cookies) could support the investigation? How can system and application logs help reconstruct the timeline of compromise? What tools can be used to extract and examine this data?		
Text Book	Text Book 2: Chapter 5,6,10, Textbook 3: Chapter 11,12		
MODULE-5	**Cyber and Network Forensics, Case Studies, Ethics, and Emerging Trends**	**24SCS323.5, 24SCS323.6**	**8 Hours**
Network Packet Capture and Analysis (Wireshark, tcpdump), Detecting Intrusions and Tracing Attack Vectors, Analysis of Log Files: IDS/IPS, Firewalls, Web Servers,Forensics in IoT and Cloud Environments. In-depth Case Studies on Cybercrime Investigations (National and Intern, Blockchain and Cryptocurrency Forensics, Ethical, Legal, and Social Implications of Digital Investigations, Emerging Trends: Digital Identity Forensics, Quantum Cryptography.
Case Study/ Application	1. A financial services company detects unusual outbound traffic. Investigation reveals a compromised user account used in a lateral movement attack. **Questions:** How can intrusion detection systems (IDS/IPS) aid in detecting such threats? What steps are involved in tracing the attack vector back to its origin? Discuss the use of tools like Snort, Suricata, or Zeek in intrusion analysis. What are the signs of privilege escalation and persistence mechanisms? 2. After a DDoS attack on an e-commerce website, forensic analysts are asked to reconstruct the event using log files.		

	Questions: Which logs (e.g., Apache, firewall, IDS) would be most relevant to analyze? What patterns in the logs indicate malicious traffic or brute force attempts? How do you correlate multiple log sources to understand a full attack scenario. What are the challenges in log integrity and tampering?
Text Book	Text Book 2: Chapter 8, Textbook 3: Chapter 10,11,13,14, Text Book 4: Chapter 7,14

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	-	-
L6	Create			

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

Suggested Learning Resources:

Text Books:

1. Criminology: Explaining Crime and Its Context by Brown, Esbensen, and Geis is the 11th Edition, published on June 26, 2024 by Routledge.
2. Nelson, Phillips, and Steuart – *Guide to Computer Forensics and Investigations*, Cengage, 7th Edition, ISBNs: 978-0357672884
3. Eoghan Casey – Digital Evidence and Computer Crime, Academic Press, 3rd Edition, ISBN: 978-0123742681
4. Marjie T. Britz – Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, ISBN: 978-0132677714

Reference Books:

1. NIST Guidelines on Digital Forensics (NIST Special Publication 800-101, Rev. 1),2014, Gaithersburg, MD: U.S. Department of Commerce. ISBN 978-1-937294-31-5.
2. The Information Technology Act, 2000 with Amendments (including IT [Amendment] Act, 2008), Ministry of Electronics and Information Technology (MeitY), New Delhi, Latest Edition.

Web links and Video Lectures (e-Resources):

- https://www.forensicsciencesimplified.org/csi/how.html
- https://www.geeksforgeeks.org/computer-science-fundamentals/cyber-forensics/
- https://financialcrimeacademy.org/what-is-forensic-investigation/
- https://www.youtube.com/watch?v=VZcQgAboFsQ
- https://www.youtube.com/watch?v=VGuiiFJVqjc&pp=ygUYI2RpZ2l0YWxmb3JlbnNpY3R1dG9yaWFs

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Contents related activities (Activity-based discussions)
- Organizing Group wise discussions on issues
- Seminars
- Data Driven Case studies
- Cross Platform Comparative Learning

HIGH PERFORMANCE COMPUTING				
Course Code	24SCS324		CIE Marks	50
L:T:P:S	3:0:0:0		SEE Marks	50
Hrs / Week	03		Total Marks	100
Credits	03		Exam Hours	03

Course outcomes:

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

24SCS324.1	Understand HPC components, memory, and interconnects.
24SCS324.2	Compare shared vs. distributed memory and OpenMP/MPI.
24SCS324.3	Apply parallel programming to scientific and engineering problems.
24SCS324.4	Analyze resource management and scheduling in grid computing.
24SCS324.5	Evaluate GPU-accelerated applications using CUDA/OpenACC.
24SCS324.6	Analyze performance data to identify bottlenecks and ensure fault tolerance.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
24SCS324.1	3	2	1	3	-	2	2	-
24SCS324.2	3	3	2	3	-	2	2	-
24SCS324.3	3	3	3	3	-	2	2	-
24SCS324.4	3	3	3	3	-	2	2	-
24SCS324.5	3	3	3	3	-	2	2	-
24SCS324.6	3	3	3	3	-	2	2	-

MODULE-1	HPC ARCHITECTURES AND SYSTEM FOUNDATIONS	24SCS324.1	8 Hours
	Introduction to HPC, HPC System Architecture - Flynn's taxonomy, Memory hierarchies, Basic components of an HPC system, Topologies and interconnect networks, Commodity Clusters - Design principles and types of clusters, Hardware/software building blocks, Benchmarking and Performance Metrics, Resource Management and Scheduling		
Self-study / Case Study /Applications	Case Study on IBM Summit Supercomputer		
Text Book	Text Book 1: Chapters 1, 2, 3, 4, 5		
MODULE-2	PROGRAMMING MODELS AND PARALLEL ALGORITHM DESIGN	24SCS324.2, 24SCS324.3	8 Hours
	Parallel Programming Models - Shared vs. distributed memory programming, OpenMP Vs MPI, Shared Memory Programming with OpenMP, Distributed Memory Programming with MPI, Parallel Algorithm Design, HPC Libraries and Tools		
Self-study / Case Study / Applications	Case Study on CFD Simulation with OpenFOAM		
Text Book	Text Book 1: Chapters 7, 8, 9, 10		
MODULE-3	GRID COMPUTING	24SCS324.4	8 Hours
	Introduction to Grid Scheduling and Resource Management, Taxonomy of Scheduling in Grid Environments, Resource Management Strategies, Scheduling Algorithms in Grid Computing		
Self-study / Case Study / Applications	Case Study on Worldwide LHC Computing Grid (CERN)		
Text Book	Text Book 2: Chapters 1, 2, 3, 4		
MODULE-4	ACCELERATORS AND HETEROGENEOUS COMPUTING	24SCS324.5	8 Hours

Accelerators in HPC, GPU Architecture and CUDA Programming, OpenACC Programming Model, CPU–GPU Collaboration and Data Transfer, Performance Considerations in Heterogeneous Computing			
Self-study / Case Study / Applications	Case Study on CUDA-Accelerated Deep Learning on NVIDIA DGX		
Text Book	Text Book 1: Chapters 15, 16		
MODULE-5	**PERFORMANCE TUNING AND FAULT-TOLERANT HPC**	**24SCS324.6**	**8 Hours**

Performance Monitoring and Profiling, Debugging Parallel Programs, Checkpointing and Fault Tolerance, Introduction to Resilience in HPC Systems

Self-study / Case Study / Applications	Case Study on Debugging MPI Deadlocks in Climate Models
Text Book	Text Book 1: 13, 14, 20

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
RBT Levels		**Test (s)**	**AAT1**	**AAT2**
		25	**15**	**10**
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	5	-	5
L4	Analyze	5	7.5	-
L5	Evaluate	5	7.5	-
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. High Performance Computing: Modern Systems and Practices (2nd Edition, 2024) by Thomas Sterling, Maciej Brodowicz, and Matthew Anderson, ISBN: 9780323902120.
    2. Mastering Grid Computing: Scheduling and Resource Management by Ankita & Sudip Kumar Sahana (2025, Apple Academic Press), ISBN9781003598404.

Reference Books:
   1. Introduction to High Performance Computing for Scientists and Engineers, Georg Hager & Gerhard Wellein, CRC Press, 2nd Edition (2021), ISBN9780429190612.
   2. Parallel and High-Performance Computing, Robert Robey, Yuliana Zamora, and Charlie Ferenbaugh O'Reilly Media, 1st Edition (2021), ISBN 9781617296468.

Web links and Video Lectures (e-Resources):
   ● **https://nptel.ac.in/courses/106104135**
   ● **https://www.coursera.org/learn/parallel-programming**
   ● **https://nptel.ac.in/courses/106108100**
   ● **https://courses.nvidia.com/**

- **CUDA Education & Training | NVIDIA Developer**

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

- Cluster Setup Simulation

- Parallel Program Development using OpenMP and MPI

- Case Study Analysis and Group Presentation

- Practice version control and team collaboration

- Conduct project-based learning for real-world application

- Contents related activities (Activity-based discussions)

- For active participation of students, instruct the students to prepare flowcharts and handouts

- Organizing group wise discussions on issues

- Seminars

SERVICE ORIENTED ARCHITECTURE

Course Code	24SCS325	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:

24SCS325.1	Understand the various software-oriented architectures.
24SCS325.2	Apply SOA principles to develop a medium scale software development project.
24SCS325.3	Develop SOA messages from business use cases.
24SCS325.4	Analyze modern SOA, SOA-specific methodologies, technologies and standards.
24SCS325.5	Evaluate the composite services by applying composition styles.
24SCS325.6	Use micro-services architecture to design business models.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
24SCS325.1	1	-	1	1	-	-	1	1
24SCS325.2	2	-	2	2	-	-	1	1
24SCS325.3	2	-	2	2	-	1	1	1
24SCS325.4	2	2	2	2	-	1	1	1
24SCS325.5	2	2	2	2	-	1	1	-
24SCS325.6	2	2	2	2	-	1	-	1

MODULE-1	**Introduction to SOA**	**24SCS325.1& 24SCS325.2**	**8 Hours**

Evolution of SOA: Fundamental SOA; Common Characteristics of contemporary SOA; Common tangible benefits of SOA; An SOA timeline (from XML to Web services to SOA); The continuing evolution of SOA (Standards organizations and Contributing vendors); The roots of SOA (comparing SOA to Past architectures). Web Services and Primitive SOA: The Web services framework· Services (as Web services); Service descriptions (with WSDL); Messaging (with SOAP).

Self-study / Case Study / Applications	Analyze real-world SOA adoption examples: Chalk and Talk method
Text Book	Text Book 1: 3.1 to 3.4,4.1 to 4.3, 5.1 to 5.4

MODULE-2	**Web Services and Contemporary SOA**	**24SCS325.3**	**8 Hours**

Message exchange patterns; Service activity; Coordination; Atomic Transactions; Business activities; Orchestration; Choreography. Addressing; Reliable messaging; Correlation; Polices; Metadata exchange; Security; Notification and eventing.

Self-study / Case Study / Applications	Message Exchange Patterns (MEPs): Draw various MEPs using sequence diagrams, Explore ACID properties in distributed systems using WS-Atomic Transaction: Build a small banking transaction system with rollback support
Text Book	Text Book 1: 6.1 to 6.7, 7.1 to 7.7

MODULE-3	**Principles of Service - Orientation**	**24SCS325.4**	**8 Hours**

Services orientation and the enterprise; Anatomy of a service-oriented architecture; Common Principles of Service orientation; how service orientation principles interrelate; Service orientation and object orientation; Native Web service support for service orientation principles.

Self-study/ Case Study/ Applications	Create a SOA architecture from scratch emphasizing service orientation principles: Design service boundaries, interactions, and demonstrate principle compliance

Text Book	Text Book 1: 8.1 to 8.6		
MODULE-4	**Service Layers**	**24SCS325.5**	**8 Hours**

Service orientation and contemporary SOA; Service layer abstraction; Application service layer, Business service layer, Orchestration service layer; Agnostic services; Service layer configuration scenarios.

Self-study / Case Study / Applications	Compare layered SOA deployment on-premises vs cloud hybrid and Evaluate pros/cons of each configuration for scalability and cost
Text Book	Text Book 1: 9.1 to 9.7

MODULE-5	**Business Process Design**	**24SCS325.6**	**8 Hours**

WS-BPEL language basics; WS Coordination overview; Service oriented business process design; WS addressing language basics; WS Reliable Messaging language basics. SOA Platforms: SOA platform basics; SOA support in J2EE; SOA support in. ET; Integration considerations

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: 16.1 to 18.4

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember		-	-
L2	Understand	5	-	5
L3	Apply	5	5	5
L4	Analyze	10	10	-
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology and Design", Prentice Hall Publication, 2017, ISBN: 978-0131858589.
2. Michael Rosen, Boris Lublinsky, "Applied SOA Service Oriented Architecture and Design Strategies", Wiely India Edition, 2018, ISBN 978-0470260920.

Reference Books:
1. Wolff, Eberhard. Microservices: flexible software architecture. Addison-Wesley Professional, 2016, ISBN-13: 978-0-134-60241-7
2. Martin Kalin, "Java Web Services: Up and Running" O'Reilly Media, 2008 Matjaz Juric "BPEL and WS-BPEL 2.0" Packt Publishing, 2013, ISBN 9781449365110

Web links and Video Lectures (e-Resources):
1. https://en.wikipedia.org/wiki/Service-oriented_architecture
2. https://www.youtube.com/watch?v=7rcG3s7lGB8
3. https://www.w3schools.com/xml/xml_soap.asp
4. https://www.w3.org/TR/ws-mep/
5. https://www.soapatterns.org/soa-principles
6. https://www.soainfotech.com/blog/service-layers-in-soa/

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

- **Case Study Analysis:**
  Provide a case study of a legacy monolithic system vs. SOA-based system. Ask students to identify tangible benefits gained by SOA adoption (e.g., agility, reuse).

- **Hands-on SOAP Service Creation:**
  Using tools like SoapUI or Eclipse, students create a simple SOAP Web Service with WSDL. Then test it by sending requests and viewing responses.

- **Message Exchange Patterns Simulation:**
  Role-play or simulate various message exchange patterns (one-way, request-response, solicit-response) with students as services exchanging messages.

- **WS-Addressing & Reliable Messaging Labs:**
  Configure SOAP services with WS-Addressing headers; simulate message retries to understand reliability guarantees.

- **Principles Brainstorming Workshop:**
  Students brainstorm and present how each service orientation principle (loose coupling, abstraction, reusability) applies in real-world scenarios.

- **Configuration Scenario Roleplay:**
  Simulate deployment of different service layer configurations (distributed vs co-located) and discuss trade-offs.

- **WS-BPEL Process Modeling:**
  Using tools like Eclipse BPEL Designer, students create a basic business process

PROJECT WORK PHASE-1

Course Code	24SCS34		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:

24SCS34.1	Comprehend the key principles and methodologies involved in project planning, including defining objectives, setting milestones, and creating timelines
24SCS34.2	Craft the comprehensive project proposals, encompassing clear problem statements, methodologies, expected outcomes, and resource requirements.
24SCS34.3	Apply appropriate research methodologies, including qualitative and quantitative methods, to address project objectives effectively
24SCS34.4	Develop proficient presentation skills for effectively communicating project proposals and research findings through clear, concise, and engaging oral and written presentations.
24SCS34.5	Critically evaluate project proposals, identifying strengths, weaknesses, and feasibility aspects, and apply feedback constructively to refine their work.
24SCS34.6	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	PSO1	PSO2
24SCS34.1	-	-	-	-	3	3	-	3
24SCS34.2	-	-	-	-	3	3	-	3
24SCS34.3	-	-	-	-	3	3	-	3
24SCS34.4	-	-	-	-	3	3	-	3
24SCS34.5	-	-	-	-	3	3	-	3
24SCS34.6	-	-	-	-	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 (100 Marks – Lab)

RBT Levels		Periodical Reviews & Evaluation
		100
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	20
L5	Evaluate	20
L6	Create	20

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

SOCIETAL PROJECT

Course Code	24SCS35	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:

24SCS35.1	Identify key terminology, concepts, and theories in environmental sustainability
24SCS35.2	Interpret complex environmental data to comprehend patterns and trends
24SCS35.3	Apply various environmental assessment methods and tools to analyze and evaluate environmental issues.
24SCS35.4	Analyze the interconnections between societal, economic, and environmental factors influencing sustainable development.
24SCS35.5	Critically assess the ethical implications and social responsibilities associated with environmental engineering projects
24SCS35.6	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	PSO1	PSO2
24SCS35.1	-	-	-	-	3	3	-	3
24SCS35.2	-	-	-	-	3	3	-	3
24SCS35.3	-	-	-	-	3	3	-	3
24SCS35.4	-	-	-	-	3	3	-	3
24SCS35.5	-	-	-	-	3	3	-	3
24SCS35.6	-	-	-	-	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
		100
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	20
L5	Evaluate	20
L6	Create	20

INTERNSHIP

Course Code	24SCSI36	CIE Marks	50
L:T:P:S	0:0:0:6	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:

24SCSI36.1	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.
24SCSI36.2	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.
24SCSI36.3	Develop and implement innovative solutions to technical challenges encountered during the internship, showcasing adaptability, critical thinking, and troubleshooting abilities.
24SCSI36.4	Engage in effective communication with team members, supervisors, and stakeholders, demonstrating the ability to collaborate within multidisciplinary teams and present ideas coherently.
24SCSI36.5	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
24SCSI36.6	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	PSO1	PSO2
24SCSI36.1	-	-	-	-	3	3	-	3
24SCSI36.2	-	-	-	-	3	3	-	3
24SCSI36.3	-	-	-	-	3	3	-	3
24SCSI36.4	-	-	-	-	3	3	-	3
24SCSI36.5	-	-	-	-	3	3	-	3
24SCSI36.6	-	-	-	-	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	24SCS41	**CIE Marks**		100
L:T:P:S	0:0:20:0	**SEE Marks**		100
Hrs / Week	3	**Total Marks**		200
Credits	20	**Exam Hours**		03

Course outcomes:

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

24SCS41.1	Demonstrate proficiency in advancing the project initiated in Phase-1, showcasing enhanced development, implementation, and refinement of the project solution.
24SCS41.2	Apply innovative problem-solving methodologies to address complex technical challenges encountered during the project's advancement, showcasing adaptability and creativity.
24SCS41.3	Integrate advanced technologies, tools, or frameworks within the CSE domain to augment the project's functionalities or performance, demonstrating technical prowess and innovation
24SCS41.4	Conduct critical analysis and evaluation of project methodologies, algorithms, or implementations, demonstrating the ability to assess and justify the chosen approaches effectively.
24SCS41.5	Produce comprehensive documentation, technical reports, or research papers detailing the advanced stages of the project, including methodologies, experimental results, modifications made, and their impact.
24SCS41.6	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	PSO1	PSO2
24SCS41.1	-	-	-	-	3	3	-	3
24SCS41.2	-	-	-	-	3	3	-	3
24SCS41.3	-	-	-	-	3	3	-	3
24SCS41.4	-	-	-	-	3	3	-	3
24SCS41.5	-	-	-	-	3	3	-	3
24SCS41.6	-	-	-	-	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 University 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	24MOOC2	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.

*****
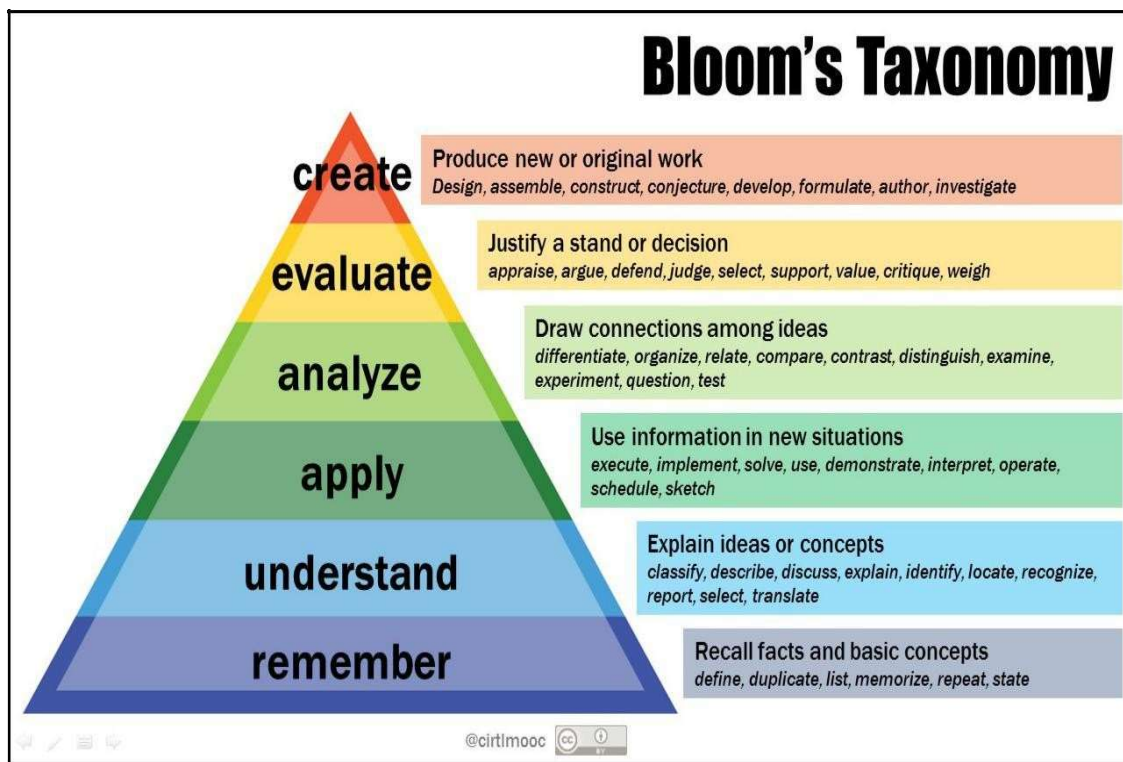
www.newhorizonindia.edu

Follow us