Society for Computer Technology & Research's (SCTR's)

Pune Institute of Computer Technology (PICT), Pune

An Autonomous Institute affiliated to the Savitribai Phule Pune University (SPPU)
Approved by AICTE & Government of Maharashtra,
Accredited by NAAC (A+) & NBA [All eligible UG Programs]

Syllabus for

S.Y. B. Tech. Information Technology (IT)

(2025-26 Course) *

With effect from (June 25)
National Education Policy (NEP) 2020 Compliant
*Approved by the Board of Studies (BoS) and Academic Council

Abbreviations used (Refer [1-3] for more details)

Sr. No.	Broad Category of the course	Sub- Category of course	Category Code
I.	Basic Science/ Engineering Science Course (BSC/ ESC)	Basic Science Course (BSC)	01
		Engineering Science Course (ESC)	02
II.	Program Courses (PC)	Program Core Course (PCC)	03
		Program Elective Course (PEC)	04
III.	Multidisciplinary Courses (MC)	Multidisciplinary Minor (MDM)	05
		Open Elective (OE) Other than particular program	06
IV.	Skill Courses (SC)	Vocational and Skill Enhancement Course (VSEC)	07
V.	Humanities Social Science and Management (HSSM)	Ability Enhancement Course (AEC-01, AEC-02)	08
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		Indian Knowledge System (IKS)	10
		Value Education Course (VEC)	11
VI.	Experiential Learning Courses (ELC)	Research Methodology (RM)	12
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Detailed guidelines for Evaluation and Assessment:

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Detailed guidelines for examination:

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Semester -III			Teaching Scheme (Hours/Week)				Credit Scheme				Examination / Evaluation Scheme and Marks						
Course Type	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	Theory			Practical			Sem. Total
											CIE [20]	ISE [20]	ESE [60]	CIE TW	ESE P	ESE OR	
PCC	3303101	Data Structures & Applications (DSA)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	3303102	Computer Network Technology (CNT)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	3303203	Data Structures & Applications Laboratory (DSAL)	-	4	-	4	-	2	-	2	-	-	-	25	50	-	75
PCC	3303204	Computer Network Technology Laboratory (CNTL)	-	4	-	4	-	2	-	2	-	-	-	50	-	25	75
VSEC	3307201	Essential Skills Development Lab. (ESDL)	-	2	-	2	-	1	-	1	-	-	-	50	-	-	50
EEM	3309101	Entrepreneurial Software Development and Management (ESDM)	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
MDM	03051X1	MDM-1	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
MDM	03052X1	MDM-1 #	-	2	-	2	-	1	-	1	-	-	-	-	25	-	25
OE	0306301	Foreign Language Studies (OE-I : FLS)	-	-	2	2	-	-	2	2	-	-	-	50	-	-	50
VEC	0311101	Universal Human Values (UHV)	2	-	-	2	2	-	-	2	-	-	-	25	-	-	25
AEC	0308202	Professional Development and Career Readiness (PDCR)	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
CEP	03132XX	CEP/Field project /CCA	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
Total			12	16	2	30	12	8	2	22	80	80	240	250	75	25	750

L: Lecture, P: Practical, T: Tutorial.

CIE: Continuous Internal Evaluation, ISE: In-Semester Examination, ESE: End-Semester Examination.

TW: Term work, OR: Oral, P: Practical examination.

Second Year B. Tech. Curriculum Structure (Semester – IV) w.e.f. A.Y. 2025-26

Semester -IV			Teaching Scheme (Hours/Week)				Credit Scheme				Examination / Evaluation Scheme and Marks						
Course Type	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	Theory			Practical			Sem. Total
											CIE [20]	ISE [20]	ESE [60]	CIE (TW)	ESE (P)	ESE (OR)	
PCC	3403105	Advanced Data Structures and Applications (ADSA)	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
PCC	3403106	Database and Information Systems (DIS)	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
PCC	3403107	Discrete and Statistical Mathematics (DSM)	2	-	1	3	2	-	1	3	20	20	60	25	-	-	125
PCC	3403208	Advanced Data Structures and Applications Laboratory (ADSAL)	-	4	-	4	-	2	-	2	-	-	-	25	25	-	50
PCC	3403209	Database and Information Systems Laboratory (DISL)	-	4	-	4	-	2	-	2	-	-	-	25	25	-	50
VSEC	3407202	Project Based Learning (PBL)#	-	2	-	2	-	1	-	1	-	-	-	-	-	25	25
EEM	3409302	IP Strategies and Economics (IPSE)	-	-	2	2	-	-	2	2	-	-	-	50	-	-	50
MDM	04051X2	MDM-2	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
MDM	04052X2	MDM-2 #	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
OE	04063XX	Open Elective-II *(OE-II)	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50
AEC	0408203	Collaborative Skills, Digital Ethics, and Cyber Security (CDC)	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
VEC	0411102	Indian Constitution & Social Responsibility (ICSR)	1	-	-	1	1	-	-	1	-	-	-	25	-	-	25
CEP	04132XX	CEP / Field project (FP) / CCA $	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
Total			9	16	5	30	9	8	5	22	80	80	290	225	50	25	750

#: Tutorial or laboratory as applicable. Choose one course from the MDM baskets. MDM: X is basket number, **Refer** Annexure-I for MDM details.

*: Open elective (OE) offered by online platform such as SWAYAM/NPTEL, **Refer** Annexure-II for details.

$: Student should choose any one course from Community Engagement project (CEP) /Field project (FP) /CCA prescribed in the syllabus at the start of semester.

X: Serial numbers of the courses under that particular category.

Second Year B-Tech
(S. Y. B-Tech.)
Semester-3

Second Year B. Tech. (S. Y. B. Tech) AY (2025-26)
Information Technology (IT)
[3303101]: Data Structures and Applications (DSA)

Semester	Credits	Teaching Scheme	Examination Scheme
3	03	L: 03 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Programming Languages- C, CPP, Basic Object-oriented concepts.

Course Objectives: The objective of this course is to provide students with

- To introduce students to fundamental concepts of data, data objects, and structures, including their classifications, abstract data types, and practical applications of linked structures.
- To familiarize students with the implementation and applications of stacks and queues and provide an understanding of algorithm design and analysis, focusing on efficiency and complexity.
- To enable students to comprehend, implement, and analyse a variety of sorting and searching algorithms, including their time and space complexities.
- To provide students with an understanding of hashing techniques, collision resolution strategies, and file organization methods for efficient data storage and retrieval.

Course Outcomes: After completing this course, students will be able to

CO1: Analyze and implement data structures such as arrays, linked lists, and generalized linked lists, and apply recursive techniques to solve complex problems.

CO2: Design stacks and queues using static and dynamic data structures, evaluate their efficiency, and apply them to real-world scenarios like expression evaluation.

CO3: Design various sorting and searching algorithms. **Evaluate** performances of searching sorting algorithms and determine the best approach for specific problem scenarios.

CO4: Design efficient hashing techniques, resolve collisions effectively, and compare file organization methods for optimized data storage and access.

COURSE CONTENTS

Module-I	Introduction to Data structures	10 Hrs.

Data Structures Overview: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures.
Abstract Data Types (ADTs), Arrays, multidimensional arrays, pointers, dynamic memory allocation.
Iteration and Recursion: Recursive algorithms, solving problems with recursion.
Linked structures: Linked lists singly and doubly, circular linked lists, introduction to generalized linked lists, Applications of linked lists (dynamic memory allocation, polynomial representation).
Asymptotic notations: Big-O, Big-Theta, Big-Omega notations, Frequency count, Time and space complexity.
Case Study: Representing a polynomial using a linked list (LL) and performing operations - addition, subtraction, and multiplication on given 2 polynomials.

Module-II	Linear Data Structures	10 Hrs.

Stacks: ADT, Operations (push, pop, peek), applications (expression conversion and evaluation, recursion).
Queue: ADT, Operations (enqueue, dequeue), types (circular queue, priority queue), Queue application in scheduling. Implementation of stacks and queues using arrays and linked lists.
Case Study: linked priority queue, designing stack from queue ADTs.

Module-III	Searching and Sorting Algorithms	10 Hrs.

Searching: Sequential search, Binary search, Fibonacci search. **Sorting algorithms:** Concept of Internal and external sorting. **Internal Sorting: Sorting by Insertion:** Insertion sort, **Sorting by Exchanging:** Bubble sort, Quicksort. **Sorting by Selection:** Selection sort, Tree selection, **Sorting by Merging:** Merge sort (Internal/External) **Sorting by Distribution:** Radix sort (Internal/External)
Analysis of algorithms: Time complexity comparison for searching and sorting algorithms in iterative and recursive manner.
Case Study: Tim sort, Pigeonhole sort, select an appropriate sorting and searching algorithm for books to be arranged in the library. Also apply appropriate searching algorithm for the books.

Module-IV	Hashing and Files	09 Hrs.

Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement.
File: Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.
Case Study: Hashing techniques on student database.

Text Books:

T1: Fundamentals of Data Structures in C by Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed.

T2: The Art of Computer Programming Sorting and Searching (Volume 3) by Donald E. Knuth.

T3: Data Structures using C and C++ by Yedidyah Langsam, Moshe Augenstein, Aaron M. Tenenbaum.

Reference Books:

R1: Data Structures: A Pseudocode Approach with C by Richard F. Gilberg and Behrouz A. Forouzan.

R2: Data Structures and Algorithm Analysis in C by Mark Allen Weiss.

R3: An Introduction to Data Structures with Application by Jean-Paul Tremblay, Paul Sorenson.

Relevant MOOCs Course (Course name and Weblink)

1. https://www.coursera.org/specializations/data-structures-alg
2. https://archive.nptel.ac.in/courses/106/102/106102064/
3. https://archive.nptel.ac.in/courses/106/105/106105085/
4. https://onlinecourses.nptel.ac.in/noc23_cs85/preview
5. https://archive.nptel.ac.in/courses/106/106/106106127/

Other Resources/Links:

1. https://www.w3schools.com/dsa/
2. https://www.codechef.com/roadmap/data-structures-and-algorithms
3. https://www.programiz.com/dsa
4. https://www.geeksforgeeks.org/data-structures/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3303102]: Computer Network Technology (CNT)

Semester	Credits	Teaching Scheme	Examination Scheme
3	03	L: 03 Hrs. / Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Proficiency in a high-level programming language (preferably C /C++/ Python).

Course Objectives: The objective of this course is to provide students with

- To understand the concepts of OSI model and protocol architecture
- To understand the detailed inner workings of TCP/IP protocol suite
- To understand data link layer design issues and MAC sub layer protocols
- To understand Network layer design issues, various routing algorithms and congestion control Algorithms.
- To understand transport layer protocols and application layer.

Course Outcomes: After completing this course, students will be able to

CO1: Analyze and **compare** OSI and TCP/IP network models while applying error detection and correction techniques for reliable communication.

CO2: Analyze network layer addressing, packet delivery, and routing protocols for efficient communication.

CO3: Assess transport layer functionalities, including connection establishment, flow control, congestion control, and the use of TCP/UDP.

CO4: Explore application layer protocols (e.g., DNS, HTTP, SMTP) and paradigms like client-server and peer-to-peer communication for real-world applications.

COURSE CONTENTS

Module-I	Data Link Layer & Medium Access Control.	10 Hrs.

Network Models: OSI Model, TCP/IP Model. **Data Link Layer:** Data Link Layer Services, Error Detection and Correction: Error Detection and Error Correction. **Linear Block Codes:** hamming code, Hamming Distance, parity check code. **Cyclic Codes:** CRC (Polynomials), Internet Checksum. **Framing:** fixed-size framing, variable size framing. **Flow control Protocols:** Stop-and-Wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking. **Random Access Techniques:** CSMA, CSMA/CD, CSMA/CA, **Controlled Access Techniques**: Reservation, Polling, Token Passing, Channelization. **Ethernet**: IEEE Standards- 802.3, Comparison of Ethernet Standard.
Case Study: MAC Protocols for Wireless Networks / AI-Based Collision Avoidance in CSMA/CA.

Module-II	Network Layer	10 Hrs.

Network Layer: Network Layer Services. **IPv4 Addresses:** Static and Dynamic Configuration Classful and Classless Addressing, Special Addresses, Subnetting, Super-netting, Delivery and Forwarding of IP Packet, NAT (Network Address Translation).
I**Pv4:** Datagram's, Fragmentation, Options, Checksum. **IPv6:** Addressing: Notations, Address Space, Packet Format.

Routing: Static vs Dynamic Routing Tables, Routing Protocol, Optimality Principle, Intra and Inter Domain Routing. **Unicast Routing Protocols**: Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing.
Case Study: Study of any network Layer Protocols other than TCP/IP Network / Mobile IP.

Module-III	Transport Layer	10 Hrs.

Transport layer: Transport layer services & Duties, **Transport Control Protocol:** COTS, TCP header, Services, Segments, Connection Establishment, Flow control, **Congestion Control:** Congestion Control Algorithms, Leaky Bucket, Token Bucket, Load Shedding and TCP Timers.
User Datagram Protocol: CLTS, UDP header, Datagram, Services, Applications, **Socket:** Primitives, TCP & UDP Sockets.
Case Study: How AI can help in reducing Congestion Control / SCTP, RTP Protocols**.**

Module-IV	Application Layer	09 Hrs.

Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, **Application Layer Protocols:** DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, DHCP, TELNET.
Case Study: AI-driven techniques for predicting and preloading content in Web Applications / WebRTC Role in Application like Video Conferencing.

Text Books:

T1:	Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
T2:	Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.
T3:	Kurose Ross, Computer Networking: A Top -Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1.

Reference Books:

R1:	Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition.
R2:	Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7.
R3:	Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9.
R4:	Natalia Olifer, Victor Olifer, Computer Networks: Principles, Technologies and Protocols for Network Design, , Wiley India, ISBN : 978-81-2650-9171
R5:	William, A. Shay: Understanding communications and Networks, 3rd Edition, Thomson Publication, 2006, ISBN: 978-81-7800-1791.

Relevant MOOCs Course (Course name and Weblink)

1. Computer Networks and Internet Protocol: https://archive.nptel.ac.in/courses/106/105/106105183/
2. Demystifying networking: https://onlinecourses.nptel.ac.in/noc19_cs75/preview
3. Advanced Computer Networks: https://onlinecourses.nptel.ac.in/noc24_cs11/preview

Relevant Topics for Self-study:

http://williamstallings.com/DataComm/DCC10e-Instructor/
http://library.aceondo.net/ebooks/Computer_Science/Data_Communication_and_Networking_by_Behrouz.A.Forouzan_4th.edition.pdf
https://www.javatpoint.com/computer-network-tutorial
http://nptel.ac.in/courses/106105081/1

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3303203]: Data Structures and Applications Laboratory (DSAL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	02	P: 04 Hrs./ Week	CIE (TW): 25 Marks ESE (PR): 50 Marks

Prerequisite: Students should have prior knowledge of

- **Programming Languages:** C and C++
- **Concepts:** Basic Object-Oriented Programming (OOP)

Course Objectives: The objective of this course is to provide students with

- To introduce students to fundamental concepts of data, data objects, and structures, including their classifications, abstract data types, and practical applications of linked structures.
- To familiarize students with the implementation and applications of stacks and queues and provide an understanding of algorithm design and analysis, focusing on efficiency and complexity.
- To enable students to comprehend, implement, and analyze a variety of sorting and searching algorithms, including their time and space complexities.
- To provide students with an understanding of hashing techniques, collision resolution strategies, and file organization methods for efficient data storage and retrieval.

Course Outcomes: After completing this course, students will be able to

CO1: Analyze and **implement** data structures such as arrays, linked lists, and generalized linked lists, and apply recursive techniques to solve complex problems.

CO2: Implement stacks and queues using different techniques, **evaluate** their efficiency, and **apply** them to real-world scenarios like expression evaluation and backtracking.

CO3: Critically **analyze** and **compare** various sorting and searching algorithms, **evaluate** their performance, and determine the best approach for specific problem scenarios.

CO4: Design efficient hashing techniques, resolve collisions effectively, and compare file organization methods for optimized data storage and access.

COURSE CONTENTS

Prerequisite: Practice assignments

- Perform set operations on multiple sets. Represent sets using arrays. Perform union, intersection, difference, symmetric difference.
- Create a magic square for a given size of square. Place ‘n’ queens on the chess board of size ‘n’. use recursion.

Assign. No.	Description of Assignment
1.	Linked lists (Singly/Doubly linked list) operations. Create list, add nodes, delete, search, reverse, traverse.
2.	ADT implementation: Create queues and stacks using LL.
3.	Write a program to maintain a database with at least 5-6 attributes. use sorting techniques to sort data for different attributes. use searching techniques to permit search vis different attributes (example: search using roll number, name etc) Give Time and space complexity of all algorithms used.

	[implementation: Groupwise different techniques will be asked to implement]
4.	1. Program to convert infix to prefix and postfix. evaluate postfix and prefix expressions. 2. Implement a priority queue. 3. Implement a double-ended queue.
5.	Program for hashing on key-value pairs. Demonstrate collision handling using chaining and without chaining.
6.	File operations on various examples of databases
7.	Mini project based on real world applications using STL implementation.

Text Books:	
T1:	"Data Structures Using C and C++", Aaron M. Tenenbaum, Moshe J. Augenstein, Yedidyah Langsam, Prentice Hall.
T2:	"Data Structures Using C" by Reema Thareja
T3:	"Data Structures: A Pseudocode Approach with C" by Richard F. Gilberg and Behrouz A. Forouzan
Reference Books:	
R1:	"Data Structures and Algorithm Analysis in C" by Mark Allen Weiss
R2:	"Introduction to Algorithms" by Cormen, Leiserson, Rivest, and Stein (CLRS)

Relevant MOOCs Courses / Topics for Self-study:

1. **Data Structures and Algorithms**:
   Coursera: **Data Structures and Algorithm Specialization** by UC San Diego
   edX: **Algorithm Design and Analysis** by Microsoft
   Udemy: **Master the Coding Interview: Data Structures + Algorithms**
2. **Linked Lists and ADTs**:
   GeeksforGeeks: **Linked List Tutorial**
   Khan Academy: **Abstract Data Types and Their Implementation**
3. **STL in C++**:
   Udemy: **C++ STL Masterclass**
   Pluralsight: **Using C++ Standard Template Library**
4. **Specific Algorithms and Time Complexity**:
   MIT OpenCourseWare: **Introduction to Algorithms**
   Coursera: **Design and Analysis of Algorithms**
5. **File Handling and Hashing**:
   YouTube: CodeWithHarry Playlist on File Handling (C++)
   Udemy: **Learn Data Structures and Hashing**

Other Resources/Links

Hands-on Platforms for Practice

1. **Competitive Programming and Challenges**:
   - LeetCode
   - HackerRank
   - Codeforces
   - CodeChef
2. **Visualization Tools**:
   - VisuAlgo: Data Structure and Algorithm Visualization
3. **File Operations in C++**:
   - Practice basic file I/O operations at GeeksforGeeks
4. **Hashing and Collision Handling**:
   - Programiz: Hashing in Data Structures

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)
[3303204]: Computer Network Technology Laboratory (CNTL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	02	L: 02 Hrs. / Week	ESE (OR): 25 Marks CIE (TW): 50 Marks

Prerequisite: Students should have prior knowledge of

- Fundamental Programming Skills

Course Objectives: This course is intended to prepare students:

- To provide practical knowledge of IP addressing techniques, including subnetting and super netting, to optimize network designs.
- To enable students to configure and secure networks using router commands and access control lists.
- To familiarize students with dynamic routing protocols such as RIP, EIGRP, and OSPF for efficient data routing.
- To develop programming skills for real-time communication by implementing multi-client chat applications using socket programming.
- To equip students with hands-on experience in file transfer protocols, including setting up and managing FTP/TFTP servers using Python.

Course Outcomes: After completing this course, students will be able to

CO1: Design and **configure** network topologies by **applying** subnetting and supernetting techniques in simulators.

CO2: Implement and **evaluate** router configurations and access control lists to enhance network security.

CO3: Analyze and **apply** dynamic routing protocols like RIP, EIGRP, and OSPF for efficient network communication.

CO4: Develop and **test** real-time communication applications using socket programming with multi-client functionality.

CO5: Configure, operate, and **demonstrate** FTP/TFTP servers while executing file transfer operations using Python libraries.

COURSE CONTENTS

Assign. No.	Description of Assignment
1.	Using Network Simulator (e.g. packet tracer) configure a network and perform . Sub-netting of a given network and Super-netting of a given networks.
2.	Using a Network Simulator (e.g. packet tracer) configure . A router using router commands, Access Control lists – Standard & Extended.
3.	Using a Network Simulator (e.g. packet tracer) configure network topology and implement dynamic routing protocols such as RIP, EIGRP & OSPF.
4.	Implement a chat application using socket programming using C/C++/Python with a support for multiple clients using threading or async programming
5.	Using Python's ***ftlib*** or ***pysnmp*** set up an FTP/TFTP (***pyftpdlib***) server and write a program to upload/download files to/from the server

Text Books:	
T1:	Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN-13: 978-0-07-070652-1, 4th Edition.
T2:	Kurose Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, ISBN-13: 978-81-7758-878-1.
T3:	Rick Graziani and Allan Johnson, "Routing Protocols and Concepts: CCNA Exploration Companion Guide", ISBN-10: 1587132060, ISBN13: 978 1587132063
T4:	Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", ISBN-13: 978 143 025855 1
Reference Books:	
R1.	"CCNA Routing and Switching 200-125 Official Cert Guide" by Wendell Odom, ISBN-10 : 1587205815, ISBN-13 : 978-1587205811
R2.	"Unix Network Programming: The Sockets Networking API" by W. Richard Stevens, ISBN-10 : 0139498761, ISBN-13 : 978-0139498763
R3.	"Python Networking Programming Cookbook" by M. Omar Faruque Sarker, ISBN-10: 1849513465, ISBN-13: 978-1849513463
Relevant MOOCs Course (Course name and Weblink):	
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Relevant Topics for Self-study:	

1. **Subnetting and Super netting**
   https://www.geeksforgeeks.org/introduction-to-subnetting/
   https://cycle.io/learn/subnetting-and-supernetting
   https://www.youtube.com/watch?v=G2L6ElxUanU
2. **Router Configuration and Access Control Lists (ACLs)**
   https://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/13788-3.html
   https://www.scribd.com/document/376971013/Networking-Lab-Workbook-University-of-Jordan
3. **Dynamic Routing Protocols (RIP, EIGRP, OSPF)**
   https://www.geeksforgeeks.org/computer-network-tutorials/
   https://www.skillsoft.com/channel/networking-core-concepts-9eb0ab00-e253-11e6-91a7-0242c0a80704
4. **Socket Programming for Chat Applications**
   https://www.geeksforgeeks.org/simple-chat-room-using-python/
   https://www.packtpub.com/product/python-network-programming-cookbook-second-edition/9781784396008
5. **FTP/TFTP Server Setup and File Transfer using Python**
   https://docs.python.org/3/library/ftplib.html
   https://pyftpdlib.readthedocs.io/en/latest/
   https://github.com/msoulier/tftpy

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)
[3307201]: Essential Skills Development Lab (ESDL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	01	P: 02 Hrs. / Week	CIE (TW): 50 Marks ESE: NA

Prerequisite: Students should have prior knowledge of

- Fundamental programming concepts (preferably OOPs).

Course Objectives: The objective of this course is to provide students with

This course is intended to prepare the students

- **Apply** problem-solving strategies to solve aptitude, reasoning, and programming-based challenges. *(Application)*
- **Analyze** patterns and algorithms to optimize substring search, suffix arrays, and computational problems. *(Analysis)*
- **Design** structured programs using Java syntax, object-oriented principles, and data handling techniques. *(Synthesis)*
- **Evaluate** solutions for efficiency and accuracy using competitive programming techniques and logical reasoning. *(Evaluation)*

Course Outcomes: After completing this course, students will be able to:

- **Solve** aptitude and reasoning problems with improved accuracy and speed using logical and analytical thinking. *(Application)*
- **Develop** structured Java programs by applying object-oriented principles and efficient data handling. *(Creation)*
- **Implement** competitive programming techniques, such as substring search, suffix arrays, and sliding window, to solve complex problems. *(Application)*
- **Assess** the efficiency of algorithms and optimize solutions for time and space complexity in competitive programming scenarios. *(Evaluation)*

COURSE CONTENTS

Group A	Problem Solving and Reasoning
1.	**Aptitude: -** Numerical Reasoning, Data Interpretation, Logical Reasoning, Pattern Recognition
2.	**Puzzles: -** Coding Puzzles, Brain Teasers, Data Analysis, Interpretation Puzzles, System Design Puzzles, Bridge and Torch, Mislabelled Jars
3.	**Quiz: -** C, C++, HTML, CSS
Group B	**Java Programming**
4.	**Programming Language (JAVA) Syntax and semantics:** Students are expected to solve a problem statement to Demonstrate the use of variables, data types, and operators etc. **Sample statement**: Write a program that calculates the area of a rectangle using length * breadth.
5.	**Structuring the Data:** Students are expected to solve a problem statement to demonstrate the use of data structures like Array, strings, and Vector **Sample statements:** • Write a Java program that uses arrays to store the marks of 5 students and finds the average. • Use a HashMap to store and display student names with their roll numbers.

6.	**Classes and Methods:** Students are expected to solve a problem statement to demonstrate the use of class, object, and methods. **Sample statements:** a. Write a class Student with attributes: name, rollNo, and marks. Include methods to input data and display the student's result. b. Implement a constructor overloading with a Book class that can be initialized with (a) title only, (b) title and author, and (c) title, author, and price.
7.	**Computations and Program:** Students are expected to solve a problem statement to demonstrate Computations and loops.
Group C	**Competitive programming**
8.	**Substring search:** Students are expected to solve a problem statement to demonstrate the Substring search / pattern matching. **Sample statement:** Alice loves solving puzzles and recently found an old parchment containing a secret message. However, the message is hidden within a much longer string of gibberish. She knows the hidden message is a substring, and she wants to find **all the starting indices** where it appears in the larger string. Help Alice locate **every occurrence** of a given substring (pattern) within a longer string (text)? Use efficient algorithms such as **Knuth-Morris-Pratt (KMP)** or **Rabin-Karp** for optimal performance.
9.	**Suffix array construction:** Students are expected to solve a problem statement to demonstrate Suffix array construction. **Sample statement:** Write a program that constructs the suffix array for the given string. A single string S of length **1 ≤ |S| ≤ 10^5**, consisting of **lowercase English letters**.
10.	**Number Theory:** Students are expected to solve a problem statement to demonstrate Number Theory like Coprime Count Quest, **Euler Totient Function**, **prime factorization**. **Sample statement:** find the count of numbers **coprime** with N in the range from 1 to N.
11.	**Sliding window, two pointers:** Students are expected to solve a problem statement to demonstrate Sliding window, two pointers. **Sample statement:** You are given an array of N integers and an integer K. Your task is to find the **length of the longest contiguous subarray** whose sum is **less than or equal to K**.
Text Books:	
T1:	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
T2:	Quantitative Aptitude and Logical Reasoning for CAT" by R.S. Aggarwal
T3:	Java: The Complete Reference, by Herbert Schildt, 12th Edition
Reference Books:	
R1:	Competitive Programmer's Handbook by Antti Laaksonen
Relevant MOOCs Course (Course name and Weblink) / Relevant Topics for Self-study:	
GETTING STARTED WITH COMPETITIVE PROGRAMMING : NPTEL :: Computer Science and Engineering - NOC:Getting Started with Competitive Programming	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)
[3309101]: Entrepreneurial Software Development and Management (ESDM)

Semester	Credits	Teaching Scheme	Examination Scheme
3	02	L: 02 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Fundamental programming languages.

Course Objectives: This course is intended to prepare the students

- To introduce students to the software development process and practices.
- To familiarize students with project planning, scheduling, and resource allocation techniques.
- To provide an in-depth understanding of the principles and practices of software project management.
- To introduce formal methods and recent trends in Software Engineering.

Course Outcomes: After completing this course, students will be able to:

CO1: Compare various software development methodologies, such as Agile, Waterfall, and select appropriate methodology to enhance project outcomes.

CO2: Create project schedule, estimate the budget, and use resource management skills/tools for software development scenarios.

CO3: Demonstrate the ability to plan, execute, and manage software projects effectively using best practices.

CO4: Identify the role of testing and recent techniques used in software project development/ management.

COURSE CONTENTS

Module-I	Introduction Software Development Methodologies	08 Hrs.

Software Engineering Fundamentals: Nature of Software, Software Engineering

Process Models: Need of Process Models, A Generic Process Model, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Agile Software Development; Agile manifesto, Introduction to Scrum and Extreme Programming, Comparing Traditional and Iterative Approaches

Software Requirement Specifications (SRS): SRS Document, Structure of SRS, Writing SRS

Requirements Analysis: Analysis Model, Scenario-based modelling, Data Modelling, Class-based modelling, Flow oriented modelling, behavioural modelling.

Case Study: Requirement Management/ Design Tools

Module-II	Project Planning	06 Hrs.

Project Planning: Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, PERT/ CPM

Project Estimation: Software Project Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.

Case Study: on Project Planning

Module-III	Project Management	06 Hrs.

Quality Concepts: Quality, software quality, Quality Metrics, software quality dilemma, achieving **software quality. Project Management:** The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement: size & function-oriented metrics (FP & LOC), Metrics for Project

Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Mitigation, Monitoring and Management.
Case Study: Project Management Tools (Jira/ ClickUp / Asana)

Module-IV	Formal Methods, Recent Trends and Entrepreneurial Product Development	06 Hrs.

Testing Strategies and Tools: White box Testing, Black box Testing, Unit Testing, Integration Testing, System Testing, Automation Tools
Emerging Trends in IT Project Management: Technology Evaluation, Process Trends, Software Reuse, Collaborative Development, Continuous Integration, Test Driven Development.
Entrepreneurial Product Development: Introduction to product development, identifying market needs and idea validation, developing minimum viable product, business model and monetization strategies, scaling and funding the product.
Case Study: Testing/ Collaboration Tools (Jenkins/ teamcity/ github-actins)

Text Books:

T1:	Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill, ISBN 0-07-337597-7.
T2:	Ian Sommerville, "Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

R1:	Joseph Phillips, "IT Project Management-On Track From start to Finish", Tata Mc Graw-Hill, ISBN13:978-0-07106727-0, ISBN-10:0-07-106727-2.
R2:	Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13:9788-1203-4898-1

Relevant MOOCs Course (Course name and Weblink)

- https://nptel.ac.in/courses/106101061
- https://nptel.ac.in/courses/106105182
- https://nptel.ac.in/courses/106105218

Relevant Topics for Self-study (Paper References**):**

- https://ieeexplore.ieee.org/document/10488855
- https://ieeexplore.ieee.org/document/9123372
- https://ieeexplore.ieee.org/document/10246944
- https://ieeexplore.ieee.org/document/9186107
- https://ieeexplore.ieee.org/document/9851663
- https://ieeexplore.ieee.org/document/9496156
- https://ieeexplore.ieee.org/document/5750007
- https://ieeexplore.ieee.org/document/6690135
- https://ieeexplore.ieee.org/document/7592412

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Information Technology (IT) [03051X1]: Multidisciplinary Minor (MDM-1)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**02**	**L: 02 Hrs./ Week**	**ISE: 20 Marks** **CIE: 20 Marks** **ESE: 60 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y. B. Tech.) A.Y. (2025-26) Information Technology (IT) [03052X1]: Multidisciplinary Minor Lab (MDM-1)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**01**	**P: 02 Hrs./ Week**	**ESE (P): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Information Technology (IT) [0306301]: OE-I Foreign Language Studies (FLS)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**02**	**Tut.: 02 Hrs./ Week**	**CIE (TW): 50 Marks**
Refer Annexure-II			
Select any one course listed in Annexure II.			

Second Year
B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0311101]: Universal Human Values (UHV)

Semester	Credits	Teaching Scheme	Examination Scheme
3	02	L: 01 Hr. / Week T: 01 Hr. / Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- UHV-I: Universal Human Values-Introduction (SIP)

Course Objectives: The objective of this course is to provide students with

- An appreciation for the essential complementarity between 'values' and 'skills' as a foundation for sustained happiness and prosperity — the core aspirations of every human being.
- A holistic perspective on life and profession, grounded in a correct understanding of human reality and the rest of existence. This perspective supports the development of universal human values and encourages value-based living in a natural and integrated manner.
- Insights into the practical implications of a holistic understanding — fostering ethical human conduct, trustful and fulfilling relationships, and mutually enriching interactions with nature. This serves as an essential orientation in value education for young and curious minds.

Course Outcomes: After completion of this course, students will be able to

CO1: Distinguish between values and skills; differentiate happiness from the accumulation of physical facilities; compare the Self and the Body and **evaluate** the role of intention and competence in human behavior.

CO2: **Analyze** the importance of harmonious relationships based on trust and respect, and **apply** these principles in personal and professional life.

CO3: **Examine** the role of human beings in establishing harmony with society and nature; **develop** strategies for ethical living and professional conduct.

COURSE CONTENT

Module-I	Basic aspiration of Human being & Harmony in Human being	12 Hrs.

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations. Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure self-regulation and Health.

Module-II	Harmony in the Family, society & Nature / Existence	12 Hrs.

Harmony in the Family – the Basic Unit of Human Interaction, Values in Human–to–Human Relationship, Nine universal values in relationships viz. Trust, Respect, Affection, Care, Guidance, Reverence, Glory, Gratitude, Love. Understanding Harmony in Society, Vision for the Universal Human Order, Human Order Five Dimension. Understanding Harmony in the Nature, self–regulation & mutual fulfillment among the Four orders of Nature, Realizing Existence as co-existence at all levels holistic perception of harmony in existence.

Textbooks:	
T1.	Gaur, R. R., Sangal, R., and Bagaria, G. P. *Human Values and Professional Ethics* 3rd revised ed., PHI, Excel Books Pvt. Ltd., New Delhi, 2010.
Reference Books:	
R1.	Nagaraj, A. *Jeevan Vidya: Ek Parichaya*. Jeevan Vidya Prakashan, Amarkantak, 1999.
R2.	Tripathi, A. N. *Human Values*. New Age International Publishers, New Delhi, 2004.
R3.	Krishnamurthy, J. *The Story of My Experiments with Truth* – by Mohandas Karamchand Gandhi on Education.
R4.	Dharampal. *Rediscovering India*. Hind Swaraj or *Indian Home Rule* – by Mohandas K. Gandhi.
R5.	Gandhi, M. K. *Hind Swaraj or Indian Home Rule*.
Websites and Online Resources:	
W1.	**Universal Human Values** • Link: Universal Human Values - YouTube • The focus of Universal Human Values is to guide learners in discovering what they find truly valuable in all aspects of life—individual, family, society, and nature/existence—while strengthening their resolve to uphold and live by these values.
W2.	**English eSIP Module 1 Universal Human Values I (UHV I) Session 1& 2** • Link: https://www.youtube.com/live/OgdNx0X923I?feature=shared • This video module introduces Universal Human Values (UHV), explores life without clarity of basic aspirations, and highlights the importance of right understanding, relationships, and physical facilities.
Relevant MOOCs Course (Course name and Weblink)	
1.	NPTEL Course: Visions of Happiness and Perfect Society, by Prof. A. K. Sharma, Humanities and Social Sciences, IIT Kanpur. **Link:** NPTEL :: Humanities and Social Sciences - Exploring Human Values: Visions of Happiness and Perfect Society.
Relevant Topics for Self-study:	
Making the Right Choices: Staying True to Your Values Despite Outside Pressure How Kindness and Understanding Help Build Strong Relationships	

List of Tutorials:

Sr. No.	Problem Statement	Hrs.	CO
1.	Analyze inherent relationships and harmony through self-exploration and evaluate the shift toward universal human consciousness and a holistic world vision.	2	CO1, CO3
2.	Reflect on personal experiences to identify patterns in human consciousness, and assess the influence of natural acceptance on decision-making.	2	CO1
3.	Differentiate between the needs of the Self and the Body; evaluate the sources of imagination within the Self; relate mental well-being to physical health.	2	CO1
4.	Analyze the role of trust and respect in human interactions, and evaluate their impact on personal and societal relationships.	2	CO2
5.	Reflect on personal family experiences to identify value systems and evaluate their contribution to societal harmony.	2	CO2, CO3
6.	Document and discuss real-life examples of universal human values like trust, respect, and gratitude in human relationships.	2	CO2
7.	Analyze the interconnectedness of self, family, and society, and assess how personal well-being contributes to societal harmony.	2	CO2, CO3
8.	Investigate natural ecosystems for balance and self-regulation, and propose ways humans can align their behavior with ecological harmony.	2	CO3

Second Year B. Tech (S. Y. B. Tech) AY (2025-26)
Information Technology (IT)

[0308202]: Professional Development and Career Readiness (PDCR)

Semester	Credits	Teaching Scheme	Examination Scheme
3	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Soft Skills (SS)

Course Objectives: The objective of this course is to provide students with

- The skills to prepare a good resume, as well as prepare for interviews and group discussions.
- The ability to explore desired career opportunities in the employment market while considering their personal strengths, weaknesses, opportunities, and threats (SWOT).
- The necessary career skills to partake in and fully pursue a successful career path.

Course Outcomes: After completing this course, students will be able to

CO1: Prepare the resume on an appropriate template without any grammatical and syntax errors, and Present and Discuss with students.
CO2: Participate in a simulated interview and evaluate own performance for betterment.
CO3: Demonstrate effective communication skills through Group Discussion, self-management attributes.
CO4: Define personal and career goals (short-term and long-term) using introspective skills and Perform SWOT assessment.
CO5: Identify career opportunities in consideration of potential and aspirations.

COURSE CONTENTS

Expt. No.	Task to carry out	Hrs.	CO
1.	**Resume Skills** • Introduction of resume and its importance • Difference between a CV, resume and biodata • Essential components of a good resume. • Common errors while preparing a resume	4	CO1
2.	Prepare a good resume considering all essential components and present the resume	2	CO 1
3.	**Interview Skills: Preparation and Presentation** • Meaning and types of interviews (F2F, telephonic, video, etc.) • Dress code, background research, dos and don'ts. • Situation, task, action, and response (STAR concept) for facing an interview. • Interview procedure (opening, listening skills, and closure). • Important questions generally asked at a job interview (open- and close-ended questions)	2	CO 2
4.	**Interview Skills: Common Errors** • Discuss the common errors that candidates generally make at an interview • Demonstrate an ideal interview	2	CO 3

5.	**Group Discussion Skills** • Meaning and Methods of Group Discussion • Procedure of Group Discussion • Group Discussion — Simulation Group Discussion — Common Errors	2	CO 3
6.	**Strengths, Weaknesses, Opportunities and Threats Analysis (SWOT):** • To carryout introspection and become aware of one's Strengths, Weakness, • Opportunities and Threats. • Document SWOT analysis in a matrix format.	2	CO 3
7.	**Exploring Career Opportunities** • Knowledge about the world of work, requirements of jobs, including self-employment. • Sources of career information. • Preparing for a career based on potential and availability of opportunities.	2	CO 4

Text Books:

T1.	Bhattacharya, I. *An Approach to Communication Skills*. Dhanpat Rai.
T2.	Chauhan, R. G. S., and Sharma, S. *Soft Skills: An Integrated Approach to Maximize Personality*. Wiley, First Edition, 2016.

Reference Books:

R1.	Sweeney, S. *English for Business Communication*. Cambridge University Press.
R2.	Kumar, S., and Lata, P. *Communication Skills*. Oxford University Press.
R3.	Kalam, A. P. J. *Ignited Minds: Unleashing the Power Within India*. Penguin Books India, New Delhi, 2003.

Relevant Topics for Self-study:

- Foundation Skills in IT (FSIT) — Refer to the websites like https://www.sscnasscom. com/ssc-projects/capacity-building-and-development/training/fsit/ and
- Global Business Foundation Skills (GBFS) – Refer websites like https://www. sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0313201]: Community Engagement Project (CEP)

Semester	Credits	Teaching Scheme	Examination Scheme
3	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of social and ethical responsibilities.
- Teamwork and communication skills acquired in prior coursework or group activities.
- Familiarity with problem-solving methodologies and project planning.

Course Objectives: The objective of this course is to provide students with

- Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
- An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes: After completing this course, students will be able to

CO1: Identify and Analyze community needs and challenges by engaging with stakeholders and evaluating real-world problems. *(Remembering & analyzing)*

CO2: Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues. *(Creating & applying)*

CO3: Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations. *(Evaluating & Understanding)*

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Project Scope:

The CEP should focus on addressing a specific community or societal issue. Projects may fall under the following themes:

1. **Education and Awareness:**
   - Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
2. **Technology for Social Good:**
   - Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
3. **Environmental Sustainability:**

- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.

4. **Health and Wellness:**

- Promote health through awareness programs on hygiene, nutrition, and exercise.

5. **Skill Development:**

- Teach basic computer or technical skills to students, staff, or the community.

C. Step-by-Step Execution Plan:

1. Planning Phase:

- **Team Formation:**

Form teams of 3-4 students with a balance of skills and interests.

- **Project Selection:**

Choose a project theme and define a clear objective that aligns with community needs.

- **Proposal Submission:**
  - Submit a one-page project proposal outlining:
  - Title of the project.
  - Objective and expected outcome.
  - Plan of execution (timeline and activities).
  - Required resources (if any).
  - Get approval from the designated faculty mentor.

2. Execution Phase:

- **Phase 1 Activities**
  - Conduct initial outreach and engage with the community or target participants.
  - Implement planned activities with close teamwork and documentation.
- **Phase Activities**
  - Continue engagement and collect feedback from the participants.
  - Begin summarizing the outcomes of the project.
- **Best Practices:**
  - Maintain a positive attitude and open communication with the community.
  - Respect cultural norms and values of the participants.
  - Adapt your plan based on real-time needs or challenges.

3. Reporting Phase:

- **Documentation:**
  - Create a detailed report containing
  - Title, objective, and scope of the project.
  - Activities conducted and timeline.
  - Outcomes and community feedback.
  - Photos/videos of the activities (if permitted).
  - Challenges faced and how they were addressed.
- **Presentation:**
  - Each team will present their project to a panel of faculty members or peers, showcasing their efforts and outcomes.
  - Duration of presentation: 5-7 minutes per team.

D. Evaluation Criteria:

Projects will be evaluated based on:

1. **Relevance:** How well the project aligns with community needs.
2. **Impact:** The tangible and intangible benefits delivered to the community.
3. **Innovation:** Creativity in the approach or solution provided.
4. **Teamwork:** Collaboration and effective delegation within the group.
5. **Documentation & Presentation:** Clarity, depth, and overall delivery of the report and presentation.

E. Guidelines for Conduct:

1. **Behavior:** Students should display professionalism, punctuality, and respect.
2. **Safety:** Follow all safety protocols during on-campus or fieldwork activities.
3. **Feedback:** Collect feedback from participants to measure the success and identify areas for improvement.

F. Support and Supervision:

1. Faculty mentors will be assigned to each group to guide them throughout the project.
2. A resource or helpdesk will be available for logistical or technical support.

Reference Books:

R1. Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education*. Stylus Publishing, 2017. A practical guide for community engagement projects, including tools and strategies for effective implementation and assessment.

R2. Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects*. Routledge, 1997. Insights into service-learning methodology, planning, and assessment techniques for impactful projects.

R3. Beckman, M., and Long, J. F. *Community-Based Research: Teaching for Community Impact*. Stylus Publishing, 2016. Approaches for conducting research and engagement projects collaboratively with communities.

R4. IDEO.org. *Design Thinking for Social Innovation*. IDEO Press, 2015. Explains how to apply design thinking to solve social problems, ideal for projects focusing on community engagement.

R5. Sherrod, L. R., Torney-Purta, J., and Flanagan, C. A. (Eds.). *Handbook of Research on Civic Engagement in Youth*. Wiley, 2010. A detailed guide on youth involvement in civic and community projects, with case studies and strategies for engagement.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. UNESCO: Education for Sustainable Development

- Website: https://www.unesco.org
- Focus: Resources and case studies related to sustainability and community engagement.

W2. EPICS (Engineering Projects in Community Service)

- Website: https://engineering.purdue.edu/EPICS
- Focus: Offers methodologies and tools for engineering students to work on real-world projects benefiting communities.

W3. Ashoka: Innovators for the Public

- Website: https://www.ashoka.org
- Focus: Information on social entrepreneurship and community innovation projects.

W4. Design for Change

- Website: https://www.dfcworld.com
- Focus: Templates, toolkits, and project ideas for implementing impactful community-based projects.

For Evaluation and Impact Assessment:

W5. Community Tool Box (University of Kansas)

- Website: https://ctb.ku.edu
- Focus: Comprehensive resources for community engagement, project evaluation, and measuring outcomes.

W6. UN SDG (Sustainable Development Goals) Knowledge Platform

- Website: https://sdgs.un.org/
- Focus: Guidance on aligning community engagement projects with UN Sustainable Development Goals (SDGs).

W7. Campus Compact

- **Website: https://www.compact.org/**
- **Focus: Resources on civic and community engagement for students and educators, with a focus on project assessment.**

W8. BetterEvaluation

- Website: https://www.betterevaluation.org
- Focus: Tools and frameworks to evaluate the impact of community projects effectively.

W9. lan-Do-Check-Act Cycle (PDCA) – Deming Institute

- Website: https://deming.org/explore/pdsa
- Focus: Step-by-step guides for planning, implementing, and refining community projects.

Relevant MOOCs Course (Course name and Weblink)

1. NPTEL course: Ecology and Society, by Prof. Ngamjahao Kipgen, IIT Guwahati
   This course delves into the dynamic relationships between human cultures and their ecological environments, focusing on human-environment interactions and sustainable development.
   Link: https://onlinecourses.nptel.ac.in/noc20_hs77/preview.
2. NPTEL course: Basics of Health Promotion and Education Intervention, by Dr. Arista Lahiri, Dr. Sweety Suman Jha (IIT Kharagpur), Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar (AIIH&PH, Kolkata)
   This course provides a comprehensive understanding of health promotion and education interventions, covering planning, implementation, and evaluation strategies.
   Link: https://onlinecourses.nptel.ac.in/noc22_ge18/preview
3. NPTEL course: A Hybrid Course on Water Quality – An Approach to People's Water Data, by IIT Madras
   This hybrid course emphasizes practical fieldwork, including water sample collection and analysis, engaging with communities to assess water quality.
   Link: https://elearn.nptel.ac.in/shop/iit-workshops/completed/a-hybrid-course-on-water-quality-an-approach-to-peoples-water-data/?v=c86ee0d9d7ed

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0313202]: Field Project (FP)

Semester	Credits	Teaching Scheme	Examination Scheme
3	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- Hands-on, real-world experience in applying engineering concepts through practical problem-solving and teamwork.
- The ability to analyze real-world field situations by identifying key challenges and requirements.
- The skills to apply engineering knowledge, tools, and techniques to develop effective solutions.
- The capability to critically evaluate their fieldwork outcomes in terms of impact, feasibility, and sustainability.

Course Outcomes: After completing this course, students will be able to

CO1: Assess field conditions and identify problems through observation and interaction with stakeholders.

CO2: Develop and **execute** a practical, field-based solution or prototype aligned with the identified needs.

CO3: Reflect on and evaluate the project outcomes in terms of their technical, social, and ethical impact.

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Field Project Execution Guidelines

1. **Team Formation and Topic Selection:**
   - Students form groups of 3-4.
   - Select a project aligned with an engineering problem or theme, such as:
     - Environmental monitoring and solutions.
     - Designing small-scale engineering systems.
     - Infrastructure or community development.
     - Renewable energy solutions.
2. **Proposal Submission:**
   - Prepare a proposal that includes:
     - Project title and objectives.
     - Problem statement and proposed solution.
     - Field location and timeline.
     - Required resources.
   - Obtain faculty mentor approval.
3. **Fieldwork:**
   - Conduct site visits, data collection, and stakeholder interactions.
   - Design or develop the solution based on field observations.
   - Ensure proper documentation of all activities.

4. **Reporting and Presentation:**
    - Prepare a detailed report with:
        - Objectives, methodology, and field observations.
        - Design, implementation, and results.
        - Challenges faced and lessons learned.
    - Present the report and findings to faculty and peers.

Reference Books:

R1. Walesh, S. G. *Engineering Your Future: The Professional Practice of Engineering*. Cengage Learning, 2012. Real-world applications of engineering principles, teamwork, and ethical practices.

R2. Phillips, R., and Johns, J. *Fieldwork for Human Geography*. Sage Publications, 2012. Field research methodologies, data collection techniques, and stakeholder engagement.

R3. Oberlender, G. D. *Project Management for Engineering and Construction*. McGraw-Hill Education, 2014. Planning and managing projects with practical tools for engineers.

R4. Williams, D. E. *Sustainable Design: Ecology, Architecture, and Planning*. Wiley, 2007. Field-based solutions emphasizing sustainability and environmental impact.

R5. Martin, M. W., and Schinzinger, R. *Introduction to Engineering Ethics*. McGraw-Hill, 2005. Ethical considerations in fieldwork and engineering projects.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. Engineering Projects in Community Service (EPICS)
- Website: https://engineering.purdue.edu/EPICS
- Focus: Resources for field-based projects benefiting communities.

W2. Community Toolbox
- Website: https://ctb.ku.edu
- Focus: Guidelines for project planning, stakeholder engagement, and evaluation.

W3. National Geographic Education – Fieldwork Resources
- Website: https://education.nationalgeographic.org/
- Focus: Tips for conducting fieldwork, documenting findings, and analyzing data.

W4. Better Evaluation
- Website: https://www.betterevaluation.org
- Focus: Frameworks and tools for project evaluation and impact assessment.

W5. Design for Change (DFC)
- Website: https://www.dfcworld.com
- Focus: Step-by-step guidance for impactful, design-based field projects.

W6. PDCA (Plan-Do-Check-Act) Methodology
- Website: https://deming.org/explore/pdsa
- Focus: Tools for iterative project planning and improvement during field execution.

Relevant MOOCs Course (Course name and Weblink)

1. Project Management, by Prof. Ramesh Anbanandam, IIT Roorkee,
   Link: https://onlinecourses.nptel.ac.in/noc24_mg01/preview.
2. Project Planning & Control, by Prof. Koshy Varghese, IIT Madras,
   Link: https://onlinecourses.nptel.ac.in/noc19_ce30/preview.
3. Project Management: Planning, Execution, Evaluation and Control, by Prof. Sanjib Chowdhury, IIT Kharagpur.
4. Link: https://onlinecourses.nptel.ac.in/noc24_mg78/preview.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0313203]: Co-Curricular Activity (CCA)

Semester	Credits	Teaching Scheme	Examination Scheme
3	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- An opportunity to acquire skills and competencies beyond the core curriculum.
- A foundation for holistic personality development.
- Preparation for future academic, professional, and personal growth.

Course Outcomes: After completing this course, students will be able to

CO1: Demonstrate the ability to lead and participate in teams.

CO2: Develop several important life skills such as leadership, organization, confidence time management, and socialization.

CO3: Improve self-confidence and decision-making abilities.

CO4: Experience the importance of community involvement.

COURSE GUIDELINES

As part of the implementation of autonomy with effective from Academic Year 2025-26 for the UG Co-curricular activities are included as credit courses in the curriculum. Accordingly, the number of credits is incorporated in curriculum structure.

BACKGROUND

SCTR's Pune Institute of Computer Technology believes in wholistic development of student catering to the requirements of engineering attributes (program outcomes) prescribed by Washington Accord and NBA through the implementation of Outcome Based Education. There is a limited scope of attaining all the program outcomes through classroom and laboratory teaching learning process. To expand the scope of learning to acquire all the attributes, PICT proposes to institutionalize and formalize the ongoing extra and co-curricular activities which are being carried out by students by awarding due credits and a certificate at the time of their graduation in addition to the University degree certificate. The purpose of Co and extracurricular activities is primarily the acquisition of skills and competencies in areas that are not directly part of the curriculum.

SCOPE

Co-curricular activity (CCA) is an activity, performed by students, that falls outside the realm of the regular academics of college or university education. Such activities are generally social, philanthropic, and often involve others of the same age. However, as part of autonomy and NEP 2020 guidelines some of the credits are included in the curriculum as mandatory for CCA. CCA includes but are not limited to Community Service Organizations (NCC, NSS), Cultural / Ethnic Organizations, Engineering Academic Honor Societies, Engineering Clubs/ Organizations, Orientation Programs, Health Related Organizations, Professional Engineering Societies – Student Chapters, Research(Voluntary Basis), Sports, educational

activities that include, seminars, workshops, project competitions, hackathons, debate competitions, and mathematics, robotics, and engineering teams and contests.

A student can earn one/two credits per year.

The activity hours accumulated throughout the year shall be calculated by the Co-Curricular Activity Committee (CCAC) to fix the number of credits to be granted to students at the end of the year. (Note: 30 hours =1credit)

MODE OF IMPLEMENTATION

1. A committee called Co-Curricular Activity Committee (CCAC) consisting of Dean Student Affairs and all the functional in charges of various activities shall facilitate the activities.
2. Identification and inclusion of Co-Curricular Activities to be considered for Credit System.
3. Mapping each activity to the program outcomes, design the assessment methodology.
4. Define the scope, methodology, number of hours required of each activity
5. Announcement of activity calendar
6. Registration and enrollment of interested students.
7. Allocation of faculty mentors to interested students based on the activity and expertise/interest.
8. Carry out the activities, submission of weekly report in the form of logbook.
9. Submission of detailed report in prescribed format mentioning all the activities carried out along with certificates, mementoes, photographs etc.
10. End-semester assessment and certificate of appropriate credits with the grade Outstanding, Excellent, Very Good, Good, Satisfactory etc.
11. Award of consolidated certificate at the time of graduation.

LIST OF VARIOUS CO-CURRICULAR ACTIVITIES

1. ADDICTION- Annual Social Gathering
2. Alumni Association
3. Art Circle
4. Astro Club
5. Automobile Club
6. AWS Cloud Club
7. Career Guidance Cell
8. Code Chef
9. CSI
10. Cyber Security Club
11. Debate Society DEBSOC
12. Defense Aspirant Club
13. Entrepreneurship Development Cell
14. Ethicraft Club
15. Finance club (PFISOC)
16. FOSS Club
17. Game Development Club (Game Utopia)
18. IEEE (PISB)
19. IEEE APS
20. Impetus & Concepts (INC)
21. Model United Nations (MUN)
22. National Service Scheme (NSS)
23. PICTOREAL
24. ROBOCON
25. Smart India Hackathon (SIH)
26. Social media Cell
27. Sports
28. Startup and Innovation Cell
29. Student Welfare & Discipline
30. TechFiesta (PICT International Hackathon)
31. ACM (PASC)
32. TEDx PICT
33. Training and Placement
34. Universal Human Values (UHV)

Second Year B. Tech
(S.Y. B. Tech.)
Semester-4

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3403105]: Advanced Data Structures and Applications (ADSA)

Semester	Credits	Teaching Scheme	Examination Scheme
4	02	L: 02 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Basics of Fourier analysis, Signals and Systems

Course Objectives: The objective of this course is to provide students with

This course is intended to prepare the students

- Understand different tree structures and their importance in representing hierarchical data. Analyze algorithm efficiency.
- Introduce graph theory fundamentals and graph representations such as adjacency matrix and list.
- Study advanced sorting techniques to handle large datasets efficiently.
- Understand the role of data structures and algorithms in solving large-scale industrial problems.

Course Outcomes: After completing this course, students will be able to

CO1: Apply tree-based algorithms for efficient searching, insertion, and deletion operations. Analyze algorithm efficiency.

CO2: Design and implement algorithms for shortest paths, minimum spanning trees, and network flows.

CO3: Identify and **apply** appropriate data structures and algorithms in industry-relevant scenarios.

CO4: Apply advanced data manipulation techniques to solve industry-based problems.

COURSE CONTENTS

Module-I	Trees	08 Hrs.

Trees: Tree ADT, Binary Trees: Definition, properties, traversal techniques (pre-order, in-order, post-order, level wise). **Binary Search Trees (BST):** Insertion, deletion, and search operations. **Heaps and Priority Queues:** Min-heap and Max-heap: Construction, heap operations. Priority Queue using heaps, applications in scheduling algorithms. **Threaded Binary tree:** Creation, insertion, traversal.
Applications of tree: Expression tree.
Case study: Using trees in databases, XML data representation. Discussion on applications in AI (decision trees, random forests).

Module-II	Graph	07 Hrs.

Graphs: Graph ADT, Terminologies, representations (adjacency matrix, adjacency list, edge list representations). Depth-First Search (DFS), Breadth-First Search (BFS). **Shortest Path Algorithms:** Dijkstra's Algorithm, Bellman-Ford Algorithm. **Minimum Spanning Trees:** Prim's and Kruskal's algorithms. Union-Find (Disjoint Set) data structure. Topological sorting.
Case study: Applications in Network optimization (Dijkstra's for shortest paths, Kruskal's/Prim's for minimum spanning tree in communication networks). Flow algorithms in logistics and transportation systems, social networks.

Module-III	String Matching and Hashing	06 Hrs.
Introduction to External Sorting (K-Way merge sort, B-trees for disk access). Counting Sort, Naive String Matching, Knuth-Morris-Pratt (KMP) Algorithm. Perfect Hashing, Cuckoo Hashing, Universal Hashing, Suffix arrays. Huffman code. **Case Study:** Application in domain like medical, finance, security, biology, environment		
Module-IV	**Advanced Tree Data Structures and Real-World Applications**	**06 Hrs.**
B-Trees, OBST, Balanced Trees: AVL Trees, Red-Black Trees, Tries. Applications of binary trees in databases and file systems. Applications in network routing, GPS navigation systems. Applications in memory management and large-scale distributed systems (e.g., consistent hashing in distributed storage). **Case Study:** Applications: domain - medical, finance, security, biology, environment		

Text Books:	
1.	Fundamentals of Data Structures in C by Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed.
2.	Data Structures using C and C++ by Yedidyah Langsam, Moshe Augenstein, Aaron M. Tenenbaum.
3.	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

Reference Books:	
R1:	Data Structures: A Pseudocode Approach with C by Richard F. Gilberg and Behrouz A. Forouzan.
R2:	Data Structures and Algorithm Analysis in C by Mark Allen Weiss.
R3:	An Introduction to Data Structures with Application by Jean-Paul Tremblay, Paul Sorenson.
R4:	Grokking Algorithms 2nd Edition by Aditya Bhargava

Relevant MOOCs Course (Course name and Weblink)

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://archive.nptel.ac.in/courses/106/102/106102064/
3. https://archive.nptel.ac.in/courses/106/105/106105085/
4. https://onlinecourses.nptel.ac.in/noc23_cs85/preview
5. https://archive.nptel.ac.in/courses/106/106/106106127/

Relevant Topics for Self-study:

1. https://www.w3schools.com/dsa/
2. https://www.codechef.com/roadmap/data-structures-and-algorithms
3. https://www.programiz.com/dsa
4. https://www.geeksforgeeks.org/data-structures/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3403106]: Database and Information Systems (DIS)

Semester	Credits	Teaching Scheme	Examination Scheme
4	02	L: 02 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Discrete structure, Data structure

Course Objectives: This course is intended to prepare students

- To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
- To provide a strong formal foundation in database concepts, technology and practice.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To be familiar with the basic issues of transaction processing and concurrency control.

Course Outcomes: After completing this course, students will be able to

CO1: Students will be able to define relational, object oriented, hierarchical, network, ER Model, Document database model, apply database design, and query formation using relational algebra.

CO2: Students will be able to aware the impact of data redundancy while design of database and data normalization principles and will demonstrate the SQL queries.

CO3: Students will be able to describe query processing, illustrate ACID properties for transaction management, and construct advance SQL queries.

CO4: Students will be able to explain database consistency and recovery and able to describe the various architecture

COURSE CONTENTS

Module-I	RELATIONAL DATA MODEL AND RELATIONAL DATABASE CONCEPTS	08 Hrs.

Introduction: Database Concepts, Database System Architecture, Data Modelling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys.

E-R and EER diagrams: Components of E-R Model, conventions, converting E-R diagram into tables, EER Model components, converting EER diagram into tables, legacy system model.

Relational Model: Basic concepts, Attributes and Domains, Codd's Rules. Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram.

Module-II	DATABASE DESIGN AND SQL	06 Hrs.

Database Design: Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. **Decomposition:** lossless join decomposition and dependency preservation, Multi valued Normalization (4NF), Join Dependencies and the Fifth Normal Form.

Introduction to SQL: Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls.

Module-III	QUERY PROCESSING AND DATABASE TRANSACTIONS	06 Hrs.
Query Processing: Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm. **Transaction**: Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, **Serializability:** Conflict and View, Cascaded Aborts, Recoverable and No recoverable Schedules. Concept of Stored Procedures, Cursors, Triggers, assertions,		
Module-IV	**CONCURRENCY CONTROL AND INFORMATION RETRIEVAL**	**06 Hrs.**
Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery, Checkpoints. **Information Retrieval**: Introduction to Information Retrieval, Difference between Data Retrieval and Information Retrieval, Types of IR Model, User Interaction with Information Retrieval System.		

Text Books:	
T1:	Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN-0-07-120413-X, Sixth Edition
T2:	S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5
Reference Books:	
R1:	Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide",O' Reilly Publications.
R2:	Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier.
R3:	Bill Schmarzo, "Big Data: Understanding How Data Powers Big Business", Wiley, ISBN:978-81-265-4545-2.
Relevant MOOCs Course (Course name and Weblink)	
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Relevant Topics for Self-study:	
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Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3403107]: Discrete and Statistical Mathematics (DSM)

Semester	Credits	Teaching Scheme	Examination Scheme
4	03	L: 02 Hrs./ Week T: 01 Hr./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks TW: 25 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Programming Languages

Course Objectives: The course is intended to prepare the students

- To provide a strong foundation in set theory and relations, focusing on their properties and operations.
- To understand Graph and Tree terminologies and models to be applied in real-life problems.
- To understand the basics of number theory and its applications and understand the various types of algebraic structures.
- To equip students with statistical tools and probability distributions for analyzing and interpreting data.

Course Outcomes: After completing this course, students will be able to

CO1: Formulate problems, **apply** formal proof techniques precisely and **analyze** types of relations and functions to provide solutions to computational problems.

CO2: Analyze and **apply** the concepts of graph theory in solving real-life problems.

CO3: Apply concepts of number theory to illustrate its application and **identify**, **describe**, and **model** fundamental algebraic structures such as groups, rings, and fields.

CO4: Apply statistical methods and probability distributions to **model** and **solve** practical data-driven problems.

COURSE CONTENTS

Module-I	Sets and Relations	08 Hrs.

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.

Relations: Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations.

Case Study: Demonstrate the correlation of the concept of relations with the relational database

Module-II	Graph Theory	06 Hrs.

Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring.

Trees: Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees- Prim's and Kruskal's Algorithms, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network).

Case Study: Model a social network group as a connected graph and study simple properties of graphs

Module-III	Introduction to Number Theory and Algebraic Structures	06 Hrs.

Number Theory: Divisibility of Integers, Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem.
Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Codes and Group Codes, Ring, Integral Domain, Field.
Case Study 1: Generate a public key cryptosystem with small primesp, q for a set of alphabets.
Case Study 2: Demonstrate the application of group properties in generating group codes.

Module-IV	Statistics	06 Hrs.

Random Variables and Distribution Functions: Random Variable, Distribution Function, Properties of Distribution Function, Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function.
Theoretical Discrete Distributions: Binomial Distribution, Mean Deviation about mean of Binomial Distribution, Mode of Binomial Distribution, Additive Property of Binomial Distribution, Characteristic Function of Binomial Distribution, Poisson Distribution.
Case Study: Demand forecasting in retail using statistical distribution function

Text Books:

T1:	C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill
T2:	Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill.
T3:	J. Medhi, "Statistical Methods: An Introductory Text", Second Edition, New Age International Ltd, ISBN: 8122419577
T4:	S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics (A Modern Approach)", Sultan Chand & Sons Educational Publishers, Tenth revised edition ISBN:81-7014-791-3.

Reference Books:

R1:	Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India.
R2:	Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education.
R3:	Tremblay J. S., "Discrete mathematical structures with application", 3rd Edition, Tata McGraw Hill.
R4:	Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill.
R5:	Johnsonbaugh Richard, "Discrete Mathematics", 7th edition, Pearson.
R6:	Biggs Norman L, "Discrete mathematics", 6th edition, Oxford.
R7:	David M. Burton, "Elementary Number Theory", &7th Edition, McGraw-Hill.
R8:	Ken Black, "Applied Buisness Statistics", Wiley, 7th edition, ISBN: 9788126537075

Relevant MOOCs Course (Course name and Weblink)

- NPTEL Mooc Unit 1 and Unit 2
- NPTEL Mooc Unit 3
- NPTEL Mooc Unit 4

Relevant Topics for Self-study:
• https://arxiv.org/abs/2302.14153 • https://arxiv.org/abs/2404.05459 • https://arxiv.org/abs/1703.03728 • https://arxiv.org/abs/2309.03249 • https://arxiv.org/abs/1611.07462 • https://ideas.repec.org/a/hin/jjmath/4333301.html • https://arxiv.org/abs/2201.03295 • https://www.nature.com/articles/s41598-024-57390-7 • https://calcworkshop.com/discrete-math/ • https://calcworkshop.com/probability-and-statistics/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3403208]: Advanced Data Structures and Applications Laboratory (ADSAL)

Semester	Credits	Teaching Scheme	Examination Scheme
4	02	P: 04 Hrs./ Week	ESE (P): 25 Marks CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Fundamental of Data Structures and Applications
- Programming Language Concepts

Course Objectives: This course is intended to prepare students with

- To understand advanced data structures to solve complex problems in various domains.
- To build the logic to use appropriate data structure in logical and computational solutions.
- To develop applications using data structure algorithms.

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

CO1: Implement various sorting and searching algorithms.
CO2: Implement AVL and B- tree operations to solve complex problems.
CO3: Implement shortest path algorithm on real time problem statement like network flow problem.
CO4: Solve problem involving linear and non-linear data structures

COURSE CONTENTS

Assgn. No.	Problem Statement
1.	Implement binary search tree and perform following operations: a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Traversal) e) Display - Depth of tree f) Display - Mirror image g) Create a copy h) Display all parent nodes with their child nodes i) Display leaf nodes j) Display tree level wise (Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three).
2.	A software company is developing a new **job scheduler** that efficiently manages different processes. The goal is to minimize average **waiting time** by giving priority to Shortest time tasks **First** use a **Min-Heap (Priority Queue) for implementation. (Or** giving priority to the largest time **task First** use a **Max-Heap Priority Queue for implementation.)**
3.	Consider a binary tree and implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.
4.	A **city transportation department** is developing a **navigation system** to help users find efficient routes between different locations. Represent the city map as a **graph**, having node as each **location (place) and** Each **road connecting two locations** is an **edge**. **Explore possible routes** using **Depth-First Search (DFS) and Breadth-First Search (BFS).**
5.	1. Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find the minimum spanning tree using a) Kruskal's algorithm. B) Prim's algorithm. **Analyse above two algorithms for space and time complexity**
6.	Implementation of Huffman Coding for Data Compression. Take input as 3–4-word sentences at least.

7.	Represent a graph of the city using an adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destinations. Analyze the implemented algorithm for space and time complexity.
8.	A **library management system** is developing a **text search engine** to help users quickly locate books, research papers, and articles by searching for specific keywords within large texts. Traditional **brute-force string matching algorithms** are inefficient for searching in **large datasets**, leading to slower search results. Implement KMP for string matching in a text search engine.
9.	Design PCB for any suitable digital circuit.
10.	Mini project: Design a mini project in java using different data structures
Text Books:	
T1:	Fundamentals of Data Structures in C by Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed.
T2:	Data Structures using C and C++ by Yedidyah Langsam, Moshe Augenstein, Aaron M. Tenenbaum.
T3:	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
Reference Books:	
R1:	Data Structures: A Pseudocode Approach with C by Richard F. Gilberg and Behrouz A. Forouzan.
R2:	Data Structures and Algorithm Analysis in C by Mark Allen Weiss.
R3:	An Introduction to Data Structures with Application by Jean-Paul Tremblay, Paul Sorenson.
R4:	Grokking Algorithms 2nd Edition by Aditya Bhargava.
Relevant Topics for Self-study / MOOCs:	
• https://nptel.ac.in/courses/106102064 • https://archive.nptel.ac.in/courses/106/106/106106127/ • https://archive.nptel.ac.in/courses/106/105/106105225/	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3403209]: Database and Information Systems Laboratory (DISL)

Semester	Credits	Teaching Scheme	Examination Scheme
4	02	P: 04 Hrs./ Week	CIE(TW): 25 Marks ESE(P): 25 Marks

Prerequisite: Students should have prior knowledge of

- Data Structures and Applications.

Course Objectives: The objective of this course is to provide students with

- To provide students with an understanding of Relational Database and No SQL Database.
- To enable students to execute SQL/PL SQL queries such as joins, set operations, and aggregate functions.
- To enable students to design and create no SQL database systems using MongoDB.
- To familiarize students with the design and implementation of database applications on their own.

Course Outcomes: After completing this course, students will be able to

CO1: Design and implement a database schema for given problems.
CO2: Formulate queries using SQL DML/DDL/DCL commands for MYSQL Relation database.
CO3: Formulate queries for No SQL Database.
CO4: Apply the normalization techniques for development of application software to realistic problems.

COURSE CONTENTS

Assign. No.	Description of Assignment
	Group A: Introduction to Databases (Study assignment)
1	Study and design a database with suitable examples using following database systems: • Relational: SQL / PostgreSQL / MySQL • Key-value: Riak / Redis • Columnar: Hbase • Document: MongoDB / CouchDB • Graph: Neo4J
2	Compare the different database systems based on points like efficiency, scalability, characteristics and performance.
	Group B: SQL and PL/SQL
3	Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system**.**
4	Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.
5	Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).
6	Write and execute suitable database triggers

7	Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
Group C: MongoDB	
8	**Create a database with suitable example using MongoDB and implement** Inserting and saving documents (batch insert, insert validation) · Removing document · Updating document (document replacement, using modifiers, upserts, updating multiple documents, returning updated documents) Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques: · find and findOne (specific values) · Query criteria (Query conditionals, OR queries, $not, Conditional semantics) · Type-specific queries (Null, Regular expression, Querying arrays) Implement Map reduce example with suitable example.
Group D: Mini Project / Database Application Development	
9	Build the mini project based on the real-life application using Relational Database (MYSQL)/No SQL Databases (MongoDB).
Text Books:	
T1:	Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN-0-07-120413-X, Sixth Edition.
T2:	S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5.
Reference Books:	
R1:	Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide", O'Reilly Pubications
R2:	Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier
R3:	Bill Schmarzo, "Big Data: Understanding How Data Powers Big Business", Wiley,ISBN:978-81-265-4545-2
Relevant MOOCs Course (Course name and Weblink)	
NPTEL Courses on DBMS.	
Relevant Topics for Self-study	
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Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3407202]: Project Based Learning (PBL)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	P: 02 Hrs./ Week	ESE (OR): 25 Marks

Prerequisite: Students should have prior knowledge of

- C/ C++/ object-oriented programming and other programming knowledge.

Course Objectives: This course is intended to prepare students

- To identify, analyze, and solve real-world problems using computer science principles.
- Apply theoretical concepts learned in their coursework (such as algorithms, data structures, and software development methodologies) to practical projects.
- Work in diverse teams to identify, analyze, and solve real-world problems using computer science principles.

Course Outcomes: After completing this course, students will be able to

CO1: **Apply** appropriate computational thinking techniques and evolve potential solutions.

CO2: **Design** and **implement** functional software projects in major software domains.

CO3: **Exhibit** strong collaboration skills by actively participating in diverse teams, contributing to group discussions, and sharing responsibilities in project development.

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch.
- The group should be cohesive, sharing and caring, and contribute to the task assigned.
- The task allocation for each week should be maintained in LOGBOOK by each group.
- Multidisciplinary and Cutting-Edge Technology projects should be encouraged.

B. Problem statement selections:

- Each course teacher will provide a list of problems statements in particular course studying in the current year. These statements will be displayed prior to the commencement of semester.
- Students are instructed to choose one out of the provided statements. The statement will be approved by course teachers on a first come first serve basis.

OR

- A group of students will find THREE problem statements in any domain. Course teachers will approve one out of that depending on resources availability, and need of time. You may use the following list to search for the appropriate project title.
  - Professional society (IEEE, IET, ACM etc.) Journal, Conference/transaction papers
  - IT project or design magazines and Web Resources on Recent Trends
  - Other professional society requirements.
  - Extension to the old projects.
  - Social, live, sponsored, consultancy projects, inter-disciplinary may be encouraged.

C. Evaluation Method:

- The project Seminar-I (Introductory seminar) and Seminar-II (Completion seminar) are compulsory.

- The course teacher will prepare rubrics for the assessment and share the same with students at the commencement of semester.
- Week wise assessment is considered under the head continuous internal evaluation (CIE).

D. Week wise Assessment schedule:

Week Scheduled	Task to be performed
Week-1	a. Formation of Group and b. Literature Survey, Finalizing the Specifications
Week-2	a. Finalization of project titles b. Seminar-I (Project Idea) Presentation
Week-3	a. Selection of the algorithms/methodology / approach b. Block schematic and architecture diagram / flow charts etc.
Week-4	a. Simulation / Implementation of modules/ functions. b. Algorithm testing
Week-5	Programming and testing of modules
Week-6	a. Integrating modules in HW/SW b. Deployment of the application
Week-7	a. Seminar –II (Project Work) Presentation
Week-8	a. Modification as per the Review comments
Week-9	a. Project Demonstration b. Project report preparation
Week-10	a. Project Exhibition b. Final report submission

Note: Students are instructed to adhere to the schedule strictly for smooth conduction of course.

Reference Books:

R1: Larmer, J., Mergendoller, J. R., & Boss, S., *Setting the Standard for Project Based Learning*, ASCD, 2015.

R2: Larmer, J., & Boss, S., *Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences*, ASCD, 2018.

R3: Murphy, E. M., & Cooper, R., *Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry*, Times 10 Publications, 2017.

Relevant MOOCs Course (Course name and Weblink)

SWYAM: Problem Based learning, by Dr. Indrajit Saha, National Institute of Technical Teachers Training and Research, Kolkata
Link: https://onlinecourses.swayam2.ac.in/ntr20_ed12/preview.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[3409302]: IP Strategies and Economics (IPSE)

Semester	Credits	Teaching Scheme	Examination Scheme
4	02	Tut.: 02 Hrs. / Week	CIE (TW): 50 Marks

Prerequisite: Students should have prior knowledge of : Cutting-edge technologies, Basic understanding of Market Dynamics.

Course Objectives: This course is intended to prepare the students with

- Developing awareness of Intellectual Property Rights (IPR) and associated ethical issues, including plagiarism, patent trolling, and safeguarding emerging technologies.
- Enhancing financial literacy for engineers by covering key concepts such as accounting, budgeting, capital budgeting, and the time value of money to support informed decision-making.
- Promoting professional excellence through the understanding of engineering practices, ethical decision-making frameworks, and the roles of professional bodies like IEEE and ASME, as per AICTE guidelines.
- Familiarizing students with emerging technologies and their impact on the IT industry, fostering innovation and problem-solving skills.

Course Outcomes: After completing this course, students will be able to

CO1: Identify and address ethical concerns in IPR while protecting technological innovations responsibly.

CO2: Make informed financial decisions using knowledge of budgeting, accounting, and investment evaluation techniques.

CO3: Apply ethical decision-making frameworks and actively engage with professional organizations like IEEE and ASME.

CO4: Analyze and apply emerging technologies to solve real-world IT challenges.

COURSE CONTENTS

Module-I	Intellectual Property Rights (IPR) and Ethics	08 Hrs.

Introduction to IPR: Definition and types of IPR: Patents, Copyrights, Trademarks, Trade Secrets, and Industrial Designs.

Ethics in IPR: Ethical dilemmas in IPR: Plagiarism, patent trolling, and unfair licensing practices.

Role of IPR in Emerging Technologies: Challenges in protecting AI, software, and other technologies.

Introduction to entrepreneurship: Definition and Concept of entrepreneurship, Relationship between entrepreneurship and IP, Role of IP strategy in entrepreneurship.

Case studies: IT industry, Ethical issues in IPR.

Module-II	Finance Management	06 Hrs.

Basic Accounting Concepts: Overview of accounting principles and practices.

Financial Statements: Understanding income statements, balance sheets, and cash flow statements.

Financial Statement Analysis: Techniques for interpreting financial performance.

Budgeting: Budget creation and management.

Capital Budgeting (CAPEX/OPEX): Decision-making for long-term investments.

Sources of Finance: Equity, debt, venture capital, and government grants.

Time Value of Money: Understanding the concept and its applications in decision-making

Case studies in finance management.

Module-III	Professional Practices in Engineering	06 Hrs.

Introduction: Definition, scope, and importance of professional engineering practices, roles of professional bodies IEEE and ASME

Engineering Ethics: Senses of ethics, moral dilemmas, autonomy, and ethical decision-making frameworks.

Theories and Frameworks: Kohlberg's and Gilligan's theories, models of professional roles, and uses of ethical theories.

Practical Applications: Case studies, consensus vs. controversy, and integrating self-interest, customs, and religion in ethical decisions.

Responsibilities of an Engineer

Professional responsibilities: Accountability, integrity, and competency. Social responsibilities: Environmental sustainability, public safety, and welfare. Managing conflicts of interest in professional settings

Module-IV	Technological Innovation	06 Hrs.

Technological Innovations: Exploration of current and emerging IT technologies (e.g., AI, IoT, blockchain, cybersecurity). **Industry 4.0 & 5.0:** Understanding smart systems, automation, digital transformation, and their implications for IT. **Sustainability in Technology:** Green computing, energy-efficient systems, and sustainable technology practices.

Case Studies: Real-world examples of successful technology adoption in the IT industry.

Text Books:

T1:	Narayanan, P., *Intellectual Property Law in India*, Eastern Law House, 2007.
T2:	Maheshwari, S.N., *Financial Accounting for Management: An Analytical Perspective*, Vikas Publishing House, 2018.
T3:	Martin, M.W., & Schinzinger, R., *Ethics in Engineering*, McGraw-Hill Education, 2005

Reference Books:

R1:	Watal, J., *Intellectual Property Rights in the WTO and Developing Countries*, Springer, 2001
R2:	Khan, M.Y., & Jain, P.K., *Financial Management: Text, Problems, and Cases*, McGraw-Hill Education, 2020.
R3:	Harris, C.E., Pritchard, M.S., & Rabins, M.J., *Engineering Ethics: Concepts and Cases*, Cengage Learning, 2013.

Relevant MOOCs Course (Course name and Weblink)

1. https://onlinecourses.nptel.ac.in/noc20_hs66/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg54/preview
3. https://onlinecourses.swayam2.ac.in/cec25_mg07/preview
4. https://onlinecourses.swayam2.ac.in/imb25_mg37/preview

Relevant Topics for Self-study / Paper References:

1. https://www.researchgate.net/publication/11839494_The_Professional_Approach_to_Engineering_Ethics_Five_Research_Questions
2. https://www.researchgate.net/publication/27275664_Engineering_Practice_and_Engineering_Ethics
3. https://www.researchgate.net/publication/291758092_Ethics_in_Finance
4. https://www.researchgate.net/publication/357993522_FINANCE_FOR_NON-FINANCE_PROFESSIONAL

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Information Technology (IT) [04051X2]: Multidisciplinary Minor (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**02**	**L: 02 Hrs./ Week**	**ISE: 20 Marks** **CIE: 20 Marks** **ESE: 60 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Information Technology (IT) [04052X2]: Multidisciplinary Minor Lab (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**01**	**P: 02 Hrs./ Week**	**ESE (P): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Information Technology (IT) [04063XX]: Open Elective-II (OE-II)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**02**	**Tut.: 02 Hrs./ Week**	**ESE: 50 Marks**
Refer Annexure-II			

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0408203]: Collaborative Skills, Digital Ethics, and Cyber Security (CDC)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Course on Soft Skills (SS)

Course Objectives: The objective of this course is to provide students with

- Recognize the importance of team skills and develop strategies to acquire them.
- Effectively design, develop, and adapt to various situations both individually and as part of a team.

Course Outcomes: After completing this course, students will be able to

CO1: Empathize with and trust colleagues for improving interpersonal relations.

CO2: Demonstrate effective communication by respecting diversity and embracing good listening skills.

CO3: Distinguish the guiding principles for communication in a diverse, smaller, internal world.

CO4: Practice interpersonal skills for better social and professional relations with seniors, juniors, peers, and stakeholders.

COURSE CONTENTS

Assgn. No.	Description	Hrs.	CO
1.	**Trust and Collaboration** Explain the Importance of Trust in Creating a Collaborative Team Agree to Disagree and Disagree to Agree – Spirit of Teamwork Understanding Fear of Being Judged and Strategies to Overcome Fear.	4	1
2.	**Listening as a Team Skill** Advantages of Effective Listening Listening as a Team Member and Team Leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre-think, use empathy, listen to tone and voice modulation, recapitulate points.).	2	2
3.	**Brainstorming** Brainstorming as a Technique to Promote Idea Generation a. Brainstorming: Meaning and the Process b. Procedure for Conducting Brainstorming c. Importance of Using Brainstorming Technique d. Types of Brainstorming	2	3
4.	Learning and Showcasing the Principles of Documentation of Team Session Outcomes.	2	3
5.	**Social and Cultural Etiquette** Need for Etiquette (impression, image, earn respect, appreciation) • Aspects of Social and Cultural/Corporate Etiquette in Promoting Teamwork • Importance of Time, Place, Propriety and Adaptability to Diverse Cultures	2	4

6.	**Digital Ethics** Digital Ethics i. Digital Literacy Skills, ii. Digital Etiquette, iii. Digital Life Skills	2	4
7.	**Cyber Security** The Art of Protecting Secrets a. Understanding Encryption and Decryption and Its Different Types b. Art of Data Masking c. Firewall and Its Proper Use in Cyber Protection	2	4

Text Books:

T1. Ratliff, J., *Leadership Through Trust & Collaboration: Practical Tools for Today's Results-Driven Leader*, Morgan James Publishing, 2020.

T2. Dauda, J., *Cybersecurity and Digital Ethics: Principles of Cybersecurity (Cybersecurity Practices, Technologies, and Processes), 2023*.

Reference Books:

R1. Kelly, T., & Kelly, D., *Creative Confidence: Unleashing the Creative Potential Within Us All*, Harper Collins Publishers India, New Delhi, 2014.

R2. Sweeney, S., *English for Business Communication*, Cambridge University Press, 2003.

R3. Kumar, S., & Lata, P., *Communication Skills*, Oxford University Press, 2015.

Students can avail additional resources to enhance soft skills further

1. SWAYAM Course: Leadership, by Prof. Kalyan Chakravarti and Prof. Tuheena Mukherjee, IIT Kharagpur Link: https://onlinecourses.nptel.ac.in/noc19_mg34/preview.
2. SWYAM course: Towards an Ethical Digital Society: From Theory to Practice, by Prof. Bidisha Chaudhuri, IIIT Bangalore
   Link: https://nptel.ac.in/course s/109106184
3. Global Business Foundation Skills (GBFS) – Refer websites like https://www. sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0411102]: Indian Constitution and Social Responsibility (ICSR)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	L:01 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic Knowledge of Civics and Governance.
- Ethical Reasoning and Social Awareness, Communication and Critical Thinking Skills.

Course Objectives: The objective of this course is to provide students with

- An understanding of the principles of social responsibility, ethical citizenship, and the Indian Constitution.
- The ability to analyze the role of individuals and institutions in fostering responsible citizenship, democracy, and social change.
- Skills to evaluate ethical dilemmas and legal frameworks for making informed civic decisions.
- Opportunities to design initiatives that promote social responsibility and active community participation.

Course Outcomes: After completing this course, students will be able to

CO1: Explain fundamental concepts of social responsibility, civic engagement, and constitutional law.
CO2: Apply ethical and legal principles to address community and global issues.
CO3: Analyze the relationship between fundamental rights, duties, and governance in India.
CO4: Develop community-driven projects that contribute to sustainable development and civic well-being.

COURSE CONTENTS

Module-I	Introduction to Indian Constitution	04 Hrs.

- Historical Background and Evolution of the Indian Constitution
- Preamble and its significance
- Fundamental Rights and Duties
- Directive Principles of State Policy

Activities:

- **Debate:** Relevance of Fundamental Rights in Contemporary India
- **Case Study:** Landmark Supreme Court Judgments

Module-II	Government Structure & Electoral System	04 Hrs.

- Separation of Powers: Legislature, Executive, and Judiciary
- Parliamentary vs. Presidential System
- Supreme Court and High Court
- Federalism: Centre-State Relations
- Election Commission and Electoral Reforms (Antidefection law)

Activities:

- **Mock Parliament Session**
- **Discussion:** Impact of Electoral Reforms on Indian Democracy. Role of executives.

Module-III	Social Responsibility & Citizenship	04 Hrs.

- Definitions of Social Responsibility and Citizenship
- Ethics and Moral Duties in Society
- Individual vs. Collective Responsibility
- Case Studies: Impactful Citizens and Social Movements

Activities:

- **Group Discussion:** What does responsible citizenship mean to you?
- **Reflection Assignment:** Personal Social Responsibility

Module-IV	Civic Engagement & Sustainable Development	04 Hrs.

- Forms of Civic Engagement (Volunteering, Advocacy, Social Activism)
- Role of NGOs, Government, and Private Sectors
- Sustainable Development Goals (SDGs)
- Corporate Social Responsibility (CSR)

Activities:

- **Role-Playing Exercise:** Simulating a Town Hall Meeting
- **Local Community Service Initiative**

Reference Books:

R1: Sen, Amartya. *The Idea of Justice,* Discusses fairness and ethics in society, 2009.

R2: D.D. Basu, *Introduction to the Constitution of India*, LexisNexis, Latest Edition.

R3: Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press.

R4: Rawls, John. *A Theory of Justice*– Covers principles of justice and democracy, 1971.

R5: United Nations Sustainable Development Goals (SDGs) – Official UN resources on social responsibility.

R6: Sachs, Jeffrey. *The Age of Sustainable Development*– Insights into global responsibility, 2015.

Relevant Online Courses (Course name and Weblink)

1. **Harvard University (edX): "Justice" by Michael Sandel** – Ethics & civic responsibility.
2. **Coursera (University of London): "Global Diplomacy – The United Nations in the World"** – Understanding international citizenship.
3. **Future Learn: "Social Responsibility and Sustainable Development"** – Corporate & personal social responsibility.
4. **Khan Academy: "Civics & Government"** – Basic concepts of democracy and civic engagement.

Relevant Topics for Self-study:

1. NPTEL course: Corporate Social Responsibility, by Prof. Aradhna Malik, IIT Kharagpur
   This course introduces participants to the field of Corporate Social Responsibility (CSR), covering its history, planning, implementation, evaluation, and future directions.
   Link: Corporate Social Responsibility
2. NPTEL course: Community Engagement and Social Responsibility, by Prof. Akshay Kumar Satsangi, Dayalbagh Educational Institute, Agra
   This course emphasizes the importance of community development through self-help groups, health and well-being, literacy, employment, and the role of social networking in bridging government schemes and the people of India.
   Link: Community Engagement and Social Responsibility.
3. NPTEL course: Constitutional Government & Democracy in India, by Prof. Amitabha Ray, St. Xavier's College (Autonomous), Kolkata
   This course acquaints students with the constitutional design of state structures and institutions, and their actual working overtime. It traces the embodiment of conflicting impulses within the constitution and encourages a study of state institutions in their mutual interaction and with the larger extra-constitutional environment.
   Link: SWAYAM: Constitutional Government & Democracy in India
4. NPTEL course: Constitution Law and Public Administration in India, By Prof. Sairam Bhat, National Law School of India University
   This course explores the intricacies of constitutional law and public administration in India, providing insights into the legal frameworks and administrative structures that govern the country.
   Link: NPTEL: Constitution Law and Public Administration in India

Any special topics of interest:

Constitutional Bodies, Competitive examinations: UPSC, MPSC, IES.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0413201]:Community Engagement Project (CEP)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of social and ethical responsibilities.
- Teamwork and communication skills acquired in prior coursework or group activities.
- Familiarity with problem-solving methodologies and project planning.

Course Objectives: The objective of this course is to provide students with

- Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
- An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes: After completing this course, students will be able to

CO1: Identify and Analyze community needs and challenges by engaging with stakeholders and evaluating real-world problems. *(Remembering & analyzing)*

CO2: Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues. *(Creating & applying)*

CO3: Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations. *(Evaluating & Understanding)*

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Project Scope:

The CEP should focus on addressing a specific community or societal issue. Projects may fall under the following themes:

1. **Education and Awareness:**
   - Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
2. **Technology for Social Good:**

- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).

3. **Environmental Sustainability:**
   - Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
4. **Health and Wellness:**
   - Promote health through awareness programs on hygiene, nutrition, and exercise.
5. **Skill Development:**
   - Teach basic computer or technical skills to students, staff, or the community.

Step-by-Step Execution Plan:

1. Planning Phase:

- **Team Formation:**

Form teams of 3-4 students with a balance of skills and interests.

- **Project Selection:**

Choose a project theme and define a clear objective that aligns with community needs.

- **Proposal Submission:**
  - Submit a one-page project proposal outlining:
  - Title of the project.
  - Objective and expected outcome.
  - Plan of execution (timeline and activities).
  - Required resources (if any).
  - Get approval from the designated faculty mentor.

2. Execution Phase:

- **Phase 1 Activities**
  - Conduct initial outreach and engage with the community or target participants.
  - Implement planned activities with close teamwork and documentation.
- **Phase Activities**
  - Continue engagement and collect feedback from the participants.
  - Begin summarizing the outcomes of the project.
- **Best Practices:**
  - Maintain a positive attitude and open communication with the community.
  - Respect cultural norms and values of the participants.
  - Adapt your plan based on real-time needs or challenges.

3. Reporting Phase:

- **Documentation:**
  - Create a detailed report containing
  - Title, objective, and scope of the project.
  - Activities conducted and timeline.
  - Outcomes and community feedback.
  - Photos/videos of the activities (if permitted).
  - Challenges faced and how they were addressed.

- **Presentation:**
  - Each team will present their project to a panel of faculty members or peers, showcasing their efforts and outcomes.
  - Duration of presentation: 5-7 minutes per team.

Evaluation Criteria:

Projects will be evaluated based on:

6. **Relevance:** How well the project aligns with community needs.
7. **Impact:** The tangible and intangible benefits delivered to the community.
8. **Innovation:** Creativity in the approach or solution provided.
9. **Teamwork:** Collaboration and effective delegation within the group.
10. **Documentation & Presentation:** Clarity, depth, and overall delivery of the report and presentation.

Guidelines for Conduct:

4. **Behavior:** Students should display professionalism, punctuality, and respect.
5. **Safety:** Follow all safety protocols during on-campus or fieldwork activities.
6. **Feedback:** Collect feedback from participants to measure the success and identify areas for improvement.

Support and Supervision:

3. Faculty mentors will be assigned to each group to guide them throughout the project.
4. A resource or helpdesk will be available for logistical or technical support.

Reference Books:

R1. Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education*. Stylus Publishing, 2017. A practical guide for community engagement projects, including tools and strategies for effective implementation and assessment.

R2. Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects*. Routledge, 1997. Insights into service-learning methodology, planning, and assessment techniques for impactful projects.

R3. Beckman, M., and Long, J. F. *Community-Based Research: Teaching for Community Impact*. Stylus Publishing, 2016. Approaches for conducting research and engagement projects collaboratively with communities.

R4. IDEO.org. *Design Thinking for Social Innovation*. IDEO Press, 2015. Explains how to apply design thinking to solve social problems, ideal for projects focusing on community engagement.

R5. Sherrod, L. R., Torney-Purta, J., and Flanagan, C. A. (Eds.). *Handbook of Research on Civic Engagement in Youth*. Wiley, 2010. A detailed guide on youth involvement in civic and community projects, with case studies and strategies for engagement.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. UNESCO: Education for Sustainable Development

- Website: https://www.unesco.org
- Focus: Resources and case studies related to sustainability and community engagement.

W2. EPICS (Engineering Projects in Community Service)

- Website: https://engineering.purdue.edu/EPICS

- Focus: Offers methodologies and tools for engineering students to work on real-world projects benefiting communities.

W3. Ashoka: Innovators for the Public

- Website: https://www.ashoka.org
- Focus: Information on social entrepreneurship and community innovation projects.

W4. Design for Change

- Website: https://www.dfcworld.com
- Focus: Templates, toolkits, and project ideas for implementing impactful community-based projects.

For Evaluation and Impact Assessment:

W5. Community Tool Box (University of Kansas)

- Website: https://ctb.ku.edu
- Focus: Comprehensive resources for community engagement, project evaluation, and measuring outcomes.

W6. UN SDG (Sustainable Development Goals) Knowledge Platform

- Website: https://sdgs.un.org/
- Focus: Guidance on aligning community engagement projects with UN Sustainable Development Goals (SDGs).

W7. Campus Compact

- **Website: https://www.compact.org/**
- **Focus: Resources on civic and community engagement for students and educators, with a focus on project assessment.**

W8. BetterEvaluation

- Website: https://www.betterevaluation.org
- Focus: Tools and frameworks to evaluate the impact of community projects effectively.

W9. lan-Do-Check-Act Cycle (PDCA) – Deming Institute

- Website: https://deming.org/explore/pdsa
- Focus: Step-by-step guides for planning, implementing, and refining community projects.

Relevant MOOCs Course (Course name and Weblink)

4. NPTEL course: Ecology and Society, by Prof. Ngamjahao Kipgen, IIT Guwahati
   This course delves into the dynamic relationships between human cultures and their ecological environments, focusing on human-environment interactions and sustainable development.
   Link: https://onlinecourses.nptel.ac.in/noc20_hs77/preview.
5. NPTEL course: Basics of Health Promotion and Education Intervention, by Dr. Arista Lahiri, Dr. Sweety Suman Jha (IIT Kharagpur), Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar (AIIH&PH, Kolkata)
   This course provides a comprehensive understanding of health promotion and education interventions, covering planning, implementation, and evaluation strategies.
   Link: https://onlinecourses.nptel.ac.in/noc22_ge18/preview
6. NPTEL course: A Hybrid Course on Water Quality – An Approach to People's Water Data, by IIT Madras
   This hybrid course emphasizes practical fieldwork, including water sample collection and analysis, engaging with communities to assess water quality.
   Link: https://elearn.nptel.ac.in/shop/iit-workshops/completed/a-hybrid-course-on-water-quality-an-approach-to-peoples-water-data/?v=c86ee0d9d7ed

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0413202]: Field Project (FP)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- Hands-on, real-world experience in applying engineering concepts through practical problem-solving and teamwork.
- The ability to analyze real-world field situations by identifying key challenges and requirements.
- The skills to apply engineering knowledge, tools, and techniques to develop effective solutions.
- The capability to critically evaluate their fieldwork outcomes in terms of impact, feasibility, and sustainability.

Course Outcomes: After completing this course, students will be able to

CO1: Assess field conditions and identify problems through observation and interaction with stakeholders.

CO2: Develop and **execute** a practical, field-based solution or prototype aligned with the identified needs.

CO3: Reflect on and evaluate the project outcomes in terms of their technical, social, and ethical impact.

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Field Project Execution Guidelines

1. **Team Formation and Topic Selection:**
   - Students form groups of 3-4.
   - Select a project aligned with an engineering problem or theme, such as:
     - Environmental monitoring and solutions.
     - Designing small-scale engineering systems.
     - Infrastructure or community development.
     - Renewable energy solutions.
2. **Proposal Submission:**
   - Prepare a proposal that includes:
     - Project title and objectives.
     - Problem statement and proposed solution.
     - Field location and timeline.
     - Required resources.
   - Obtain faculty mentor approval.
3. **Fieldwork:**
   - Conduct site visits, data collection, and stakeholder interactions.
   - Design or develop the solution based on field observations.

- Ensure proper documentation of all activities.

4. **Reporting and Presentation:**
   - Prepare a detailed report with:
     - Objectives, methodology, and field observations.
     - Design, implementation, and results.
     - Challenges faced and lessons learned.
   - Present the report and findings to faculty and peers.

Reference Books:

R1. Walesh, S. G. *Engineering Your Future: The Professional Practice of Engineering*. Cengage Learning, 2012. Real-world applications of engineering principles, teamwork, and ethical practices.

R2. Phillips, R., and Johns, J. *Fieldwork for Human Geography*. Sage Publications, 2012. Field research methodologies, data collection techniques, and stakeholder engagement.

R3. Oberlender, G. D. *Project Management for Engineering and Construction*. McGraw-Hill Education, 2014. Planning and managing projects with practical tools for engineers.

R4. Williams, D. E. *Sustainable Design: Ecology, Architecture, and Planning*. Wiley, 2007. Field-based solutions emphasizing sustainability and environmental impact.

R5. Martin, M. W., and Schinzinger, R. *Introduction to Engineering Ethics*. McGraw-Hill, 2005. Ethical considerations in fieldwork and engineering projects.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. Engineering Projects in Community Service (EPICS)
- Website: https://engineering.purdue.edu/EPICS
- Focus: Resources for field-based projects benefiting communities.

W2. Community Tool Box
- Website: https://ctb.ku.edu
- Focus: Guidelines for project planning, stakeholder engagement, and evaluation.

W3. National Geographic Education – Fieldwork Resources
- Website: https://education.nationalgeographic.org/
- Focus: Tips for conducting fieldwork, documenting findings, and analyzing data.

W4. BetterEvaluation
- Website: https://www.betterevaluation.org
- Focus: Frameworks and tools for project evaluation and impact assessment.

W5. Design for Change (DFC)
- Website: https://www.dfcworld.com
- Focus: Step-by-step guidance for impactful, design-based field projects.

W6. PDCA (Plan-Do-Check-Act) Methodology
- Website: https://deming.org/explore/pdsa
- Focus: Tools for iterative project planning and improvement during field execution.

Relevant MOOCs Course (Course name and Weblink)

1. Project Management, by Prof. Ramesh Anbanandam, IIT Roorkee,
   Link: https://onlinecourses.nptel.ac.in/noc24_mg01/preview.
2. Project Planning & Control, by Prof. Koshy Varghese, IIT Madras,
   Link: https://onlinecourses.nptel.ac.in/noc19_ce30/preview.
3. Project Management: Planning, Execution, Evaluation and Control, by Prof. Sanjib Chowdhury, IIT Kharagpur.
4. Link: https://onlinecourses.nptel.ac.in/noc24_mg78/preview.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Information Technology (IT)

[0413203]: Co-Curricular Activity (CCA)

Semester	Credits	Teaching Scheme	Examination Scheme
4	01	P: 02 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- An opportunity to acquire skills and competencies beyond the core curriculum.
- A foundation for holistic personality development.
- Preparation for future academic, professional, and personal growth.

Course Outcomes: After completing this course, students will be able to

CO1: Demonstrate the ability to lead and participate in teams.

CO2: Develop several important life skills such as leadership, organization, confidence time management, and socialization.

CO3: Improve self-confidence and decision-making abilities.

CO4: Experience the importance of community involvement.

COURSE GUIDELINES

As part of the implementation of autonomy with effective from Academic Year 2025-26 for the UG Co-curricular activities are included as credit courses in the curriculum. Accordingly, the number of credits is incorporated in curriculum structure.

BACKGROUND

SCTR's Pune Institute of Computer Technology believes in wholistic development of student catering to the requirements of engineering attributes (program outcomes) prescribed by Washington Accord and NBA through the implementation of Outcome Based Education. There is a limited scope of attaining all the program outcomes through classroom and laboratory teaching learning process. To expand the scope of learning to acquire all the attributes, PICT proposes to institutionalize and formalize the ongoing extra and co-curricular activities which are being carried out by students by awarding due credits and a certificate at the time of their graduation in addition to the University degree certificate. The purpose of Co and extracurricular activities is primarily the acquisition of skills and competencies in areas that are not directly part of the curriculum.

SCOPE

Co-curricular activity (CCA) is an activity, performed by students, that falls outside the realm of the regular academics of college or university education. Such activities are generally social, philanthropic, and often involve others of the same age. However, as part of autonomy and NEP 2020 guidelines some of the credits are included in the curriculum as mandatory for CCA. CCA includes but are not limited to Community Service Organizations (NCC, NSS), Cultural / Ethnic Organizations, Engineering Academic Honor Societies, Engineering Clubs/ Organizations, Orientation Programs, Health Related Organizations, Professional Engineering Societies – Student Chapters, Research(Voluntary Basis), Sports, educational

activities that include, seminars, workshops, project competitions, hackathons, debate competitions, and mathematics, robotics, and engineering teams and contests.

A student can earn one/two credits per year.

The activity hours accumulated throughout the year shall be calculated by the Co-Curricular Activity Committee (CCAC) to fix the number of credits to be granted to students at the end of the year. (Note: 30 hours =1credit)

MODE OF IMPLEMENTATION

1. A committee called Co-Curricular Activity Committee (CCAC) consisting of Dean Student Affairs and all the functional in charges of various activities shall facilitate the activities.
2. Identification and inclusion of Co-Curricular Activities to be considered for Credit System.
3. Mapping each activity to the program outcomes, design the assessment methodology.
4. Define the scope, methodology, number of hours required of each activity
5. Announcement of activity calendar
6. Registration and enrollment of interested students.
7. Allocation of faculty mentors to interested students based on the activity and expertise/interest.
8. Carry out the activities, submission of weekly report in the form of logbook.
9. Submission of detailed report in prescribed format mentioning all the activities carried out along with certificates, mementoes, photographs etc.
10. End-semester assessment and certificate of appropriate credits with the grade Outstanding, Excellent, Very Good, Good, Satisfactory etc.
11. Award of consolidated certificate at the time of graduation.

LIST OF VARIOUS CO-CURRICULAR ACTIVITIES

1. ADDICTION- Annual Social Gathering
2. Alumni Association
3. Art Circle
4. Astro Club
5. Automobile Club
6. AWS Cloud Club
7. Career Guidance Cell
8. Code Chef
9. CSI
10. Cyber Security Club
11. Debate Society DEBSOC
12. Defense Aspirant Club
13. Entrepreneurship Development Cell
14. Ethicraft Club
15. Finance club (PFISOC)
16. FOSS Club
17. Game Development Club (Game Utopia)
18. IEEE (PISB)
19. IEEE APS
20. Impetus & Concepts (INC)
21. Model United Nations (MUN)
22. National Service Scheme (NSS)
23. PICTOREAL
24. ROBOCON
25. Smart India Hackathon (SIH)
26. Social media Cell
27. Sports
28. Startup and Innovation Cell
29. Student Welfare & Discipline
30. TechFiesta (PICT International Hackathon)
31. ACM (PASC)
32. TEDx PICT
33. Training and Placement
34. Universal Human Values (UHV)

Annexures

Annexure-I

Structure of Multi-Disciplinary Minor Courses

The structure for the multidisciplinary Minor courses is as follows.

			Teaching Scheme (Hours/Week)				Credits				Examination Scheme and Marks						
Sem	**Course code**	**Name of Course**	**L**	**P**	**T**	**Total**	**L**	**P**	**T**	**Total credits**	**Theory**			**Practical**			**Semester Total**
											CIE	**ISE**	**ESE**	**CIE**	**ESE**		
											[20]	**[20]**	**[60]**	**TW**	**P**	**OR**	**550**
3	**03051X1**	MDM-1	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
3	**03052X1**	MDM-1 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
4	**04051X2**	MDM-2	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
4	**04052X2**	MDM-2 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
5	**05051X3**	MDM-3	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
5	**05052X3**	MDM-3 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
6	**06051X4**	MDM-4	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
6	**06052X4**	MDM-4 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
8	**08053X5**	MDM-5	-	-	2	**2**	-	-	2	**2**	-	-	-	50	-	-	**50**
		Total	**8**	**8**	**2**	**18**	**8**	**4**	**2**	**14**	**80**	**80**	**240**	**150**	**0**	**0**	**550**

Note: In course code X is a basket number. #: is laboratory or tutorial as per course requirements.

1. Students are expected to choose one of the eligible domains of MDM at the beginning of the Semester III.
2. Students will complete the chosen set of all multidisciplinary minor courses mentioned under the chosen MDM domain.
3. Students are not permitted to change from one domain to another.
4. Refer to the last column of the following table for eligibility to choose a particular MDM domain.

Lis of Multi-Disciplinary Minor Domains

Label	Multi-Disciplinary Minor Domains	SY		TY		B-Tech	Offered to students of B Tech Program
		MD1-1	MD2-2	MD3-3	MD4-4	MD5-5	
		Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII/VIII	
MD1	**Smart and Sustainable Systems (SSS)**	Fundamentals of Smart and Sustainable Systems (FSSS) & Tut	IoT for Smart and Sustainable Systems (ISSS) & Lab	Data Analytics for Smart and Sustainable Systems (DASSS) & Lab	Security for Smart and Sustainable Systems (SSS&S) Smart and Sustainable System Development (SSD) Lab	Smart and Sustainable System Development (SSD)	**ALL**
MD2	**Finance and Management (F&M)**	Fundamentals of Financial Engineering (FFE) & Tut	Banking, Financial Services and Insurance (BFSI) &Tut	Fundamentals of Stock Market (FSM) &Tut	Fintech: Foundations & Applications (FFA) &Tut	Financial Derivatives & Risk Management (FDRM)	**ALL**
MD3	**3D- Printing (3DP)**	3D modeling and Design (3MD) & Lab	Fundamentals of Additive Manufacturing (FAM)& Lab	3D Printing Materials and Processes (3DPMP)	Industry 4.0 and Digital Manufacturing (IDM)	Applied 3D Printing and Prototyping Lab (A3DPPL)	**ALL**
MD4	**Electric Vehicles (EV)**	EV foundation – Principles and Concepts (EVPC) & Lab	Advanced Motor Technologies and Power Electronics for EV(AMT) & Lab	EV Powertrain Dynamics and Control System (PDC) Tut/Lab	Intelligent EV Systems: AI IoT and Automation (IEV)	Capstone Project in Electric Mobility	**ALL**
MD5	**Applied Mathematics for Engineering (AME)**	Linear Algebra with Python & Lab	Statistical Techniques and Numerical Methods with R & Lab	Fuzzy Logic and Graph Theory with Matlab/Python & Lab	Optimization Techniques & Lab	Field Study/Case Study	**ALL**
MD6	**Software Development (SD)**	Data Structures and Algorithms (DSA) & Lab	Object Oriented Programming (OOP) &Lab	Database and Management Systems (DBMS) & Lab	Web Development (WD) & Lab	System Programming and Operating System (SPOS)	**Only E&TCE**
MD7	**Autonomous and Intelligent Systems (AIS)**	Digital Systems and Organization (DSO) & Lab	Smart System Engineering (SSE) & Lab	Embedded IoT Systems (EIS) & Lab	Autonomous Systems (AS) & Lab	Cyber Physical Systems: Screen Mode (CPS) / Capstone Project	**All except E&TCE**
MD8	**Embedded Systems (ES)**	Fundamental of Microcontroller (FM) & Lab	Embedded Processors –I (EP -I) & Lab	Microcontrollers and IoT (MI) & Lab	Embedded Systems and RTOS (ES-RTOS) & Lab	Capstone Project using Microcontrollers lab (CPML)	**All Except E&TCE**
MD9	**AI & Machine Learning (AI-ML)**	Statistical Data Analysis & Lab	Machine Learning (ML) & Lab	Natural Language Processing (NLP) & Lab	Artificial Intelligence (AI) & Lab	Deep Learning (DL)	**Only E&CE**

Link: **Detailed Syllabus**

Annexure -II

Guidelines for Open Elective Courses

1. Open Elective – I will be offered in third semester as foreign language as prescribed in the structure.
2. Open Electives – II, III, IV will be offered through SWAYAM/NPTEL MOOCs of Equivalent Credits.
3. Departments shall prepare the baskets of open elective courses from discipline/faculty other than respective major programs. Students may choose any course from the basket without adhering to any one stream.
4. Credits & Grade will be awarded based on the Marks Obtained through the certification including assignments and proctored examination as per the MOOCs Policy.

			Teaching Scheme (Hours/Week)				Credits				Examination Scheme and Marks						
Sem	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	Theory			Practical			Total
											CIE	ISE	ESE	CIE	ESE		
											[20]	[20]	[60]	TW	P	OR	
3	OE-I	Foreign Language Studies (FLS)	-	-	2	2	-	-	2	2	-	-	-	50	-	-	50
4	OE-II	MOOCs	-	-	2	2	-	-	2	2			50	-	-	-	50
5	OE-III	MOOCs	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50
6	OE-IV	MOOCs	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50

Guidelines for MOOCs

1. The department shall release a list of approved SWAYAM-NPTEL courses before the commencement of every semester.
2. Students shall register for the approved Courses as per the schedule announced by SWAYAM-NPTEL.
3. A student shall undergo the courses only from the list notified by the department through SWAYAM/NPTEL platform and complete all the assignments and examination requirements as specified by SWAYAM/NPTEL.
4. SWAYAM-NPTEL Courses are considered for transfer of credits only if the student concerned has successfully completed and obtained the SWAYAM-NPTEL Certificate.
5. The credit equivalence for SWAYAM-NPTEL Courses: 12 weeks – 3credits; 8 weeks – 2 credits; 4 weeks – 1 credit.
6. Equivalent marks will be considered for awarding the grades as specified in examination rules and regulations. The weightage for assignments is 40%, while the weightage for the proctored examination will be 60% for award calculating SGPA/CGPA. Students must score a minimum of 40% of the total marks by combining both assignments and proctored examinations

7. A student must submit the original SWAYAM-NPTEL Course Certificates to the Head of the Department concerned, with a written request for the transfer of the equivalent credits. On verification of the SWAYAM-NPTEL Course Certificates and approval by the head of the department, credits will be awarded.
8. The Institute shall not reimburse any fees/expenses a student may incur for the SWAYAM-NPTEL Courses.
9. If the SWAYAM/NPTEL course calendar does not align with the institute's calendar, the department shall facilitate and conduct examination of the relevant course of equivalent credits in physical/virtual mode and award the credits accordingly.

Detailed Syllabus for Foreign Language Studies

Choose any one course from the following courses and report that to department

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Common to all

[0306301]: Foreign Language Studies - German (FLSG)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	T: 2 Hrs./ Week	CIE: 50 Marks

Prerequisite: Nil

Course Objectives: The objective of this course is to provide students with

- Ccommunicate about everyday topics in German.
- Learn basic German grammar rules.
- Build a practical German vocabulary.
- Gain awareness of German culture.

Course Outcomes: After completing this course, students will be able to

CO1: Introduce themselves and others in German.
CO2: Describe daily life and their surroundings
CO3: Discuss time, jobs, and health in German.
CO4: Plan leisure activities and travel in German

COURSE CONTENTS

Module-I	Introduction, Personal Information, and Basic Grammar	6 Hrs.

Themes:

- Introducing oneself and others
- Hobbies
- Days of the week, months, seasons

Grammar:

- W questions
- Personal pronouns
- Simple sentences
- Verb conjugation
- Articles (definite and indefinite)
- Plurals
- Verbs "to have" and "to be"

Module Content:

- Introduction to German greetings and how to introduce oneself.
- Practicing conjugation of common verbs.
- Learning W-questions and using personal pronouns in conversation.
- Discussing hobbies and daily routines.
- Days of the week, months, and seasons in German.
- Building simple sentences using the conjugated verb forms and personal pronouns.

- Grammar practice: Definite and indefinite articles, plural forms.
- Introducing the verbs “haben” (to have) and “sein” (to be) with conjugation practice.

Activities:

- **Role-play:** Students practice introducing themselves, asking and answering W-questions.
- **Group discussion:** Students talk about their hobbies, days of the week, and favorite months/seasons using the vocabulary they learned.
- **Grammar Quiz:** Personal pronouns, articles, and verb conjugations.

Module-II	City Life, Directions, and Food	6 Hrs.

Themes:

- In the city (naming places, buildings, means of transport, basic directions)
- Food, drink, family, groceries, meals

Grammar:

- Articles and plural forms
- Negation (kein, nicht)
- Imperative forms

Module Content:

- Vocabulary related to city life: buildings, streets, means of transport.
- Giving and asking for directions.
- Learning the imperative mood for giving directions and requests.
- Vocabulary related to food, meals, and drinks.
- Talking about family and daily meal routines.
- Grammar: Using “kein” and “nicht” to form negations.
- Practice with the accusative case.

Activities:

- **City tour role-play:** Students practice asking for and giving directions.
- **Group activity:** Create a menu with German food items, then role-play ordering food.
- **Grammar exercise:** Negation using "kein" and "nicht."

Module-III	Everyday Life, Time, Professions, and Health	6 Hrs.

Themes:

- Everyday life, telling time, making appointments
- Professions
- Health and the body

Grammar:

- Prepositions: “am,” “um,” “von…bis”
- Modal verbs
- Possessive articles
- Perfect tense

Module Content:

- Telling time and scheduling appointments.
- Using prepositions (am, um, von…bis) in sentences.
- Practice with modal verbs for expressing necessity or ability.
- Talking about professions and workplace vocabulary.
- Discussing health, body parts, and feelings.

- Practice using the perfect tense for past actions.

Activities:

- **Time-based role-play:** Scheduling appointments and practicing telling time.
- **Profession Bingo:** Students match professions with corresponding vocabulary.
- **Health questionnaire:** Ask classmates about their health using body-related vocabulary and modal verbs.

Module-IV	Leisure, Travel	6 Hrs.

Themes:

- Leisure activities and celebrations
- Travel, holiday plans, weather

Grammar:

- Separable verbs
- Accusative case (continued)
- Imperative and modal verbs (review)

Module Content:

- Discussing hobbies, leisure activities, and holiday celebrations.
- Using separable verbs in the context of free time.
- Grammar review: Imperative mood, modal verbs.
- Talking about holiday plans, travel vocabulary, and discussing weather.
- Review of key grammar concepts throughout the course.

Activities:

- **Group activity:** Plan a holiday trip in German, using travel-related vocabulary and separable verbs.
- **Weather forecast role-play:** Students practice talking about the weather and making holiday plans.
- **Final review quiz:** Comprehensive review of grammar topics such as accusative, modal verbs, perfect tense, and imperative.

Reference Books:

R1: Goyal, M. *Netzwerk: Deutsch als Fremdsprache A1*. Goyal Publishers, 2015.

R2: Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)

Relevant Online Courses (Course name and Weblink)

1. NPTEL Course: German - I By Prof. Milind Brahme, IIT Madras, NPTEL
   Link: https://onlinecourses.nptel.ac.in/noc21_hs30/preview
2. PICT - Powerlingo Foreign Languages Institute
   Link: https://pict.edu/pict/
3. **FACTS ABOUT GERMANY:**
   Link: https://www.tatsachen-ueber-deutschland.de/en
4. **ONLINE GERMAN-ENGLISH DICTIONARY:**
   Link: http://www.leo.org/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)

Common to all

[0306302]: Foreign Language Studies - Japanese (FLSJ)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	T: 2 Hrs./ Week	ISE: NA Marks CIE: 50 Marks ESE: NA Marks

Prerequisite: Nil

Course Objectives: The objective of this course is to provide students with

- Enable students to communicate in basic Japanese about themselves and everyday topics.
- Develop an understanding of fundamental Japanese grammar, including particles and basic verb forms.
- Build a vocabulary related to daily life, city environments, food, leisure, and travel.
- Introduce students to aspects of Japanese culture and customs.

Course Outcomes: After completing this course, students will be able to

CO1: Introduce themselves and others and talk about their hobbies in Japanese.

CO2: Describe places in the city, give directions, and order food in Japanese.

CO3: Discuss daily routines, professions, and basic health in Japanese.

CO4: Talk about their leisure activities and travel plans in Japanese.

COURSE CONTENTS

Module-I	Introduction, Personal Information, and Basic Grammar	6 Hrs.

Themes:

- Introduction to Japanese scripts (Hiragana, Katakana)
- Introducing oneself and others (name, nationality, etc.)
- Hobbies

Grammar:

- Basic sentence structure (Subject-Object-Verb)
- Particles: wa (は), ga (が), mo (も)
- Pronouns: watashi (私), anata (あなた)
- Counters (basic introduction)

Module Content:

- Introduction to Hiragana and Katakana, basic stroke order and pronunciation.
- Greetings and introductions: Hajimemashite, Yoroshiku onegaishimasu.
- Using particles to indicate the topic and subject of a sentence.
- Talking about hobbies using simple sentence structures.
- Counting simple objects (using basic counters).

Activities:

- **Writing practice:** Hiragana and Katakana characters.
- **Role-play:** Introducing oneself to a classmate and asking about hobbies.
- Counting objects in the classroom (e.g., pencils, books).

Module-II	City Life, Directions, and Food	6 Hrs.

Themes:

- Places in the city (train station, school, supermarket, etc.)
- Asking for and giving directions
- Food and drinks

Grammar:

- Locational particles: ni (に), e (へ)
- Directional words: migi (右), hidari (左), mae (前), ushiro (後ろ)
- Verb arimasu/imasu (あります/います)

Module Content:

- Vocabulary for common places in a city.
- Giving and understanding basic directions using landmarks.
- Talking about food and drinks, ordering in a restaurant.
- Using arimasu/imasu to indicate the existence of things/people.

Activities:

- **City map activity:** Pointing out places and giving directions.
- **Restaurant role-play:** Ordering food and drinks.
- Describing the contents of a room using arimasu/imasu.

Module-III	Everyday Life, Time, Professions, and Health	6 Hrs.

Themes:

- Daily routines
- Telling time and making appointments
- Professions
- Basic health vocabulary

Grammar:

- Time expressions: ji (時), fun (分), gozen (午前), gogo (午後)
- Verb conjugation (present and past tense)
- Particles kara (から) and made (まで) to indicate time duration

Module Content:

- Describing daily routines using time expressions and verbs.
- Asking about and stating professions.
- Basic vocabulary related to health and common ailments.
- Making simple appointments.

Activities:

- **Daily routine presentation:** Describing one's daily schedule.
- **Role-play:** Making an appointment with a doctor.
- **Profession guessing game.**

Module-IV	Leisure, Travel	6 Hrs.

Themes:

- Hobbies and leisure activities
- Travel and holiday plans
- Weather

Grammar:

- ~tai desu (～たいです) to express desires
- Adjectives (review and expansion)
- Conditional form ~tara (～たら) for hypothetical situations

Module Content:

- Talking about hobbies and things you want to do.
- Describing travel plans and destinations.
- Talking about the weather.
- Using conditional sentences to express hypothetical travel scenarios.

Activities:

- **Holiday plan presentation:** Describing a dream vacation.
- **Role Play:** Weather forecast.
- **Sentence construction:** Expressing desires and hypothetical situations using ~tai desu and ~tara.

Reference Books:

R1:	Yamamoto, N. *Shin Nihongo no Kiso I (Romanized Edition)*. Association for Overseas Technical Scholars (AOTS), 3A Corporation, June 1990.
R2:	*Minna no Nihongo*. 3A Network, Goyal Publishers.
R3:	Mizutani, Osamu, and Nobuko Mizutani. *Introduction to Modern Japanese*. Japan Times, November 1992.
R4:	Nichimo, A. *250 Essential Kanji for Everyday Use*. 2nd rev. ed., Tuttle Publishing, January 2004.
R5:	*Japanese for Busy People*. 3rd ed., Association for Japanese Language Teaching, Kodansha Tokyo, Kodansha International, November 2011.

Relevant Online Courses (Course name and Weblink)

1. NPTEL Course: Introduction to Japanese Language and Culture by Prof. Vatsala Misra, IIT Kanpur Link: https://onlinecourses.nptel.ac.in/noc19_hs52/preview
2. PICT - Powerlingo Foreign Languages Institute

Link: https://pict.edu/pict/