

**DIPLOMA CURRICULUM OF
INFORMATION TECHNOLOGY
(SECOND YEAR)
(4th Semester)**

(To be implemented from 2025-26)

Prepared by;



**National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106**

Vetted by:

Domain experts from Polytechnics of Odisha



**State Council for Technical Education & Vocational Training
Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha**

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Teaching and Evaluation Scheme for Fourth Semester Information Technology													
				Study Scheme				Evaluation Scheme					
Sl. No.	Category of Course	Course Code	Course Title	Pre-requisite	Periods/ Week			Theory		Practical		Total Marks	Credit
					L	T	P	End Sem Exam	Progressive Assignment	End Sem Exam	Progressive Assignment		
1	Programme Core	ITPC202/TH1	Operating System		3	0	0	70	30	0	0	100	3
2		ITPC204/TH2	Database Management System		3	0	0	70	30	0	0	100	3
3		ITPC206/TH3	Data Communication and Computer Networks		3	0	0	70	30	0	0	100	3
4		ITPC208/PR1	Operating System lab		0	0	4	0	0	15	35	50	2
5		ITPC210/PR2	Database Management System		0	0	4	0	0	15	35	50	2
6		ITPC212/PR3	Computer Network Lab		0	0	4	0	0	15	35	50	2
7	Programme Elective	ITPE202/TH4 (Any one)	(A)Microprocessor and Micro-Controller		3	0	0	70	30	0	0	100	3
			(B)Communication Theory										
			(C)Information Theory and Coding Techniques										
8		ITPE204/TH5 (Any one)	(A) Java script		3	0	0	70	30	0	0	100	3
			(B) Programming in C++										
			(C)Cloud computing										
	Minor Project	PR 202/PR4	Minor Project		0	0	4	0	0	30	70	100	2
11	Mandatory Course	AU202	Essence of Indian Knowledge and Tradition		2	0	0	0	0	0	0	0	0
					17	0	16	350	150	75	175	750	23

SEMESTER IV
Detailed Curriculum

TH:1- OPERATING SYSTEM

L	T	P	Total Marks=100	Course Code: ITPC202/TH1
3	0	0		Theory Assessment
Total ContactHrs:45				End Term Exam:70
Theory:45				Progressive Assessment:30
Tutorial:0				Category of Course: PC
Practical:0				
Pre-requisite: NIL				
Credit:3				

RATIONALE: Operating System (OS) has been designed to provide an overview to the students of polytechnics how the hardware is managed by the system software. OS being the interfacing layer between the hardware and other system software and application software. This course is therefore an important to the students to understand the overall operation of the entire system including peripherals.

LEARNING OUTCOMES: After competing this course, student will be able to:

- Explain the basic concept about the OS,
- Illustrate UNIX/LINUX architecture,
- Explain Process management, memory management and file management,
- Demonstrate I/O system including RAID,
- Explain the concept of deadlocks and measures to prevent them,
- Illustrate OS Security.

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC/SUB-TOPIC	ALLOTED TIME (HRS.)
I	Overview of Operating System: • Basic concepts, • UNIX/LINUX Architecture, • Kernel, services and systems calls, • System programs.	6
II	Process Management: • Process concepts, • Operations on processes, • IPC, • Process Scheduling, • Multi-threaded programming	7
III	Memory management: • Memory allocation, • Swapping,	6

	• Paging, • Segmentation, • Virtual Memory, • Various faults.	
IV	File management: • Concept of a file, • Access methods, • Directory structure, • File system mounting, • Filesharing and protection, • File system structure and implementation, • Directory implementation, • Free space management, • Efficiency and performance. • Different types of file systems	10
V	I/O System: • Mass storage structure- overview, • Disk structure, • Disk attachment, • Disk scheduling algorithms, • Swap space management, • RAID types–RAID0,RAID –1, RAID 5.	6
VI	Dead Locks: • Concept of deadlock • Resources • Deadlock Prevention: Banker Algorithm & Safety Algorithm • The Ostrich Algorithm • Deadlock Detection and Recovery • Deadlock Prevention	6
VII	OS Security: • Authentication, • Access Control, • Access Rights, • System Logs	4

REFERENCE BOOKS:

1. Operating System Concepts, Silberschatz and Galvin, Wiley India Limited
2. UNIX Concepts and Applications, Sumitabha Das, McGraw-Hill Education
3. Operating Systems, Internals and Design Principles, Stallings, Pearson Education, India
4. Operating System Concepts, Ekta Walia, Khanna Publishing House
5. Modern Operating Systems, Andrew S. Tanenbaum, Prentice Hall of India
6. Operating systems, Deitel & Deitel, Pearson Education, India

TH:2- DATABASE MANAGEMENT SYSTEM

THE DATABASE MANAGEMENT SYSTEM				
L	T	P	Total Marks=100	Course Code: ITPC204/TH2
3	0	0		
Total Contact Hrs:45				Theory Assessment
Theory:45				End Term Exam:70
Tutorial:0				Progressive Assessment:30
Practical:0				
Pre-requisite: NIL				
Credit:3				Category of Course: PC

RATIONALE:

This course introduces the principles of database systems, covering foundational topics such as data models, relational algebra, and database design, progressing to advanced topics like SQL, transaction management, and database security. The course emphasizes the efficient storage, retrieval, and manipulation of data, which is essential for modern applications in various domains. The goal is to equip students with the knowledge and skills required to design, implement, and manage databases effectively, fostering analytical thinking and preparing them for data-driven decision-making in real-world scenarios.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Describe core database management concepts, including data models, schemas, architecture, and principles of transaction management.
- Design efficient databases using entity-relationship (ER) models, normalization techniques, and execute SQL queries for data manipulation and retrieval.
- Analyze relational algebra to optimize database queries and ensure consistency, isolation, and durability through transaction management.
- Evaluate database recovery techniques and security measures to ensure data integrity, performance, and protection from unauthorized access.

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Database Basics: Definition, Need, and Applications of DBMS. Database vs File System, DBMS Architecture: Components, Views of Data, Data Models (Hierarchical, Network, Relational), Introduction to RDBMS, Advantages and Disadvantages of DBMS.	6
II	Introduction to ER Models: Entities, Attributes, Relationships, and Constraints, Keys: Primary, Foreign, Candidate, and Super Keys, ER Diagrams and their components, Converting ER Diagrams to Relational Models.	8

III	Relational Algebra: Selection, Projection, Union, Intersection, Difference, Cartesian Product, and Joins, SQL Basics: Data Definition Language (DDL) and Data Manipulation Language (DML), SQL Queries: Create, Alter, Drop, Insert, Update, Delete. Basic and Advanced Queries: Filtering, Sorting, Aggregate Functions, and Group By, Joins: Inner, Outer, Left, Right, and Cross Joins.	9
IV	Database Design and Normalization: Data Redundancy and Anomalies, Functional Dependencies, Normal Forms: 1NF, 2NF, 3NF, and BCNF, Decomposition of Relations	8
V	Database Transaction Management and Concurrency Control: Transactions: Properties (ACID), States, and Schedules, Serializability and Recoverability, Concurrency Control: Locks, Deadlocks, and Timestamp Ordering.	8
VI	Database Administration and Security Management: User Management in DBMS, Privileges and Roles, Backup and Recovery, Database Security: Authentication, Authorization, and Data Encryption	6

REFERENCES:

1.	Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, 6th Edition, McGraw-Hill Education, New York, 2010.
2.	Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, India, 2015.
3.	C.J. Date, An Introduction to Database Systems, 8th Edition, Pearson Education, India, 2003.
4.	Dalwinder Singh and R.S. Salaria, Fundamentals of Database Management Systems, 1st Edition, Khanna Publishers, New Delhi, 2023.
5.	Rajiv Chopra, Database Management Systems, 1st Edition, S. Chand Publishing, New Delhi, 2016.
6.	R. Panneerselvam, Database Management Systems, 3rd Edition, PHI Learning, New Delhi, 2018.
7.	P.K. Yadav, Introduction to Database Management System, 3rd Edition, S.K. Kataria & Sons, New Delhi, 2011.

TH:3- COMPUTER NETWORKS

L	T	P	Total Marks=100	Course Code: ITPC206/TH3
3	0	0		Theory Assessment
TotalContactHrs:45				EndTermExam:70
Theory:45				ProgressiveAssessment:30
Tutorial:0				Category of Course: PC
Practical:0				
Pre-requisite: NIL				
Credit:3				

RATIONALE: Computer Networks are the backbone of any knowledge society. The entire ICT infrastructure is based on the Computer Networks. The course covers in depth the various tools and technologies that are used to cover the entire gamut of ICT based system

LEARNING OUTCOMES: After completing this course, student will be able to:

- Explain the basic concepts related to computer networks
- Explain various network media and topologies used in computer network
- Exhibit LAN & VLAN concept related to datalink layer
- Exhibit Routing algorithm and Routing Protocols
- Explain Protocols related to Application Layer
- Illustrate Networking Devices.

DETAILED COURSE CONTENT:

UNITNO.	TOPIC/SUB-TOPIC	ALLOTTED TIME (HRS.)
I	Introduction: • Introduction to computer networks • Network Models • OSI Reference Model, The layer architecture • TCP/IP Model • 4LayerofTCP/IP suite	8
II	Physical Layer: • Transmission Media–Principles and issues • Wired Media-Coaxial, UTP, STP, Fiber Optic Cables -Single Mode & Multimode. • Wireless Media–HF, VHF, UHF, Microwave, Ku Band, WIFI 802.11 a/b/g/n/ac • CellularData-2G,3G,4G,&5G • Network topologies	8
III	Data Link Layer: • Design issues • DLL protocols (Ethernet, WLAN, Bluetooth) • Switching Techniques, VLAN	5

IV	Network Layer: • Design issues • Internet Protocols (IPv4& IPv6) • Routing—principles and issues • Routing Algorithms: Distance-vector, Link-state • Routing Protocols: RIP, OSPF	8
V	Transport Layer: • Design issues, • UDP&TCP	4
VI	Application Layer: • Design Issues • DNS • DHCP • SNMP • FTP &TFTP • SMTP • WWW • Telnet & SSH	7
VII	Network Devices: • NIC, • Hub, • Switch-Core, Distribution & Access Switches • Router, • WiFi Access-Point & Wireless LAN Controller;	5
Total		45

REFERENCEBOOKS:

1. Computer Networks, 4th Edition (or later), Andrew S. Tanenbaum, PHI
2. TCP/IP Illustrated, Volume-1, W. Richard Stevens, Addison Wesley
3. Data and Computer Communications, William Stallings, PHI
4. An Engineering Approach to Computer Networking, S. Keshav, Addison Wesley/Pearson
5. An Integrated Approach to Computer Networks, Bhavneet Sidhu, Khanna Publishing House
6. Data Communication & Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed.

PR:1- OPERATING SYSTEMS LAB

L	T	P	Total Marks: 50	Course Code: ITPC208/PR1
0	0	4		Practical Assessment
Total Contact Hours				End Term Exam : 15
Practical : 60Hrs				Progressive Assessment : 35
Pre-Requisite : Nil				
Credit : 2				Category of Course : PC

RATIONALE:

Operating Systems (OS) are the backbone of modern computing, managing hardware resources and providing essential services for software execution. They ensure efficient multitasking, resource allocation, and system security, enabling seamless user and application interactions. Studying OS equips students with insights into system design, performance optimization, and troubleshooting.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Explain fundamental operating system concepts, including UNIX/Linux architecture, processes, memory management, and file systems.
- Demonstrate the use of system calls, inter-process communication (IPC) mechanisms, and process scheduling techniques in practical scenarios.
- Analyze memory allocation techniques, virtual memory concepts, and disk scheduling algorithms to assess their impact on system performance.
- Evaluate file system implementation techniques and security measures like authentication, access control, and system logs for maintaining system integrity.
- Design a system simulation that integrates process management, memory allocation, and disk scheduling to demonstrate OS functionality.

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to Linux & Terminal Commands: Use ls, pwd, cd, mkdir, rmdir, touch, cp, mv, rm, File permissions (chmod, chown, chgrp)	8
II	File Operations & Text Processing: Use cat, nano, vi, grep, awk, sed, cut, sort, uniq, diff, Redirection (>, >>, , <, tee)	8
III	Process Management: Use ps, top, htop, kill, nice, renice, jobs, fg, bg Schedule tasks using cron and at, Add, modify, and delete users/groups (useradd, usermod, passwd, groupadd, gpasswd), File ownership and permissions (chown, chmod, umask)	10
IV	Package Management: Install, remove, and update packages (apt, yum, dnf,	8

	zypper, snap), Use ifconfig, ip, ping, netstat, ss, traceroute, wget, curl SSH (ssh, scp, rsync)	
V	Disk & Storage Management: Use df, du, mount, umount, fdisk, mkfs, fsck, Creating and managing partitions & file systems, Shell Scripting - Write basic and advanced shell scripts, Implement loops, conditions, functions in bash	8
VI	System Monitoring & Performance Tuning: Use vmstat, iostat, sar, uptime, dstat, iotop, Log Management - Use journalctl, dmesg, syslog, logrotate	8
VII	Firewall & Security: Use iptables, firewallld, ufw, Configure SSH security, Linux Services & Daemons - Manage services (systemctl, service), Configure web servers (Apache, Nginx)	10

REFERENCES:

1.	Yashavant Kanetkar, UNIX Shell Programming, BPB
2.	Sumitabha Das, UNIX Concepts and Applications, 4th Edition, McGraw-Hill Education, New Delhi, 2006.
3.	Scott Seely, Windows Shell Programming, Prentice Hall India.

PR:2- DATABASE MANAGEMENT SYSTEM LAB

L	T	P	Total Marks = 50	Course Code: ITPC210/PR2
0	0	4		Theory Assessment
Total Contact Hrs: 60				End Term Exam: 15
Theory: 0				Progressive Assessment: 35
Tutorial: 0				Category of Course: PC
Practical:60				
Pre-requisite: NIL				
Credit: 2				

RATIONALE:

This course introduces the principles of database systems, covering foundational topics such as data models, relational algebra, and database design, progressing to advanced topics like SQL, transaction management, and database security. The course emphasizes the efficient storage, retrieval, and manipulation of data, which is essential for modern applications in various domains. The goal is to equip students with the knowledge and skills required to design, implement, and manage databases effectively, fostering analytical thinking and preparing them for data-driven decision-making in real-world scenarios.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Explain the core concepts of database management, including data models, schemas, database architecture, and the role of relational algebra in query optimization.
- Design efficient databases using Entity-Relationship (ER) models and normalization techniques to reduce redundancy and enhance performance.
- Apply SQL queries for data definition, manipulation, retrieval, and optimization, and understand transaction management principles such as concurrency control, consistency, isolation, and durability.
- Analyze advanced database features like indexing, views, triggers, and stored procedures to enhance database functionality, security, and integrity.
- Develop problem-solving skills to design and manage databases for real-world applications, ensuring effective database recovery, security, and data protection.

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	DBMS Lab: Installation and Basic Operations: • Installation and exploration of DBMS tools (e.g., MySQL, Oracle, or PostgreSQL). • Create a basic database and perform simple operations (e.g., create, insert, update, delete).	8

II	Database Design and ER Diagrams: - Design ER diagrams for small real-world applications (e.g., Library System, Student Management System). - Create tables from ER diagrams.	8
III	Write SQL queries for: - Table creation and modification. - Data insertion, deletion, and updating. - Querying data with filters and sorting. Joining multiple tables.	10
IV	Database Normalization and Schema Design: Normalize given datasets to remove redundancy and anomalies. Identify keys and dependencies in sample schemas.	8
V	Transaction Management and Locking Mechanisms in SQL: Simulate transaction operations (commit, rollback). Demonstrate locking mechanisms using SQL.	8
VI	Indexing and File Organization Techniques for Query Optimization: Create indexes on tables to optimize query performance. Demonstrate the use of different file organization techniques.	8
VII	Database Security and User Management: - Create user accounts and assign privileges. - Implement basic database security using roles and permissions. Demonstrate database backup and restore operations.	05
VIII	Take Any Case Study from the following	
a)	Case Study-1: Employee database – ‘Create’ employee table, ‘Select’ and display an employee matching a given condition, ‘Delete’ duplicate records, delete rows using triggers, insert and update records, find net salary, etc.	
b)	Case Study-2: Visitor Management database	
c)	Case Study-3: Students Academic database	
d)	Case Study-4: Inventory Management System database	
e)	Case study-5: Bank Operations database	

REFERENCES:

1.	Sergey Skudaev, Learn SQL By Examples,
2.	Ivan Bayross, SQL, PL/SQL – The Programming Language of Oracle, BPB
3.	Brandon Cooper, SQL: The Ultimate Beginner's Step-by-Step Guide to Learn SQL Programming with Hands-On Projects, El-Gorr International Consulting Limited

LIST OF EQUIPMENTS:

Hardware : i) Windows based Server
ii) Stand alone PC
(for detail, please refer Annex – I)
* Connected in Client Server environment.

Software : i) Oracle & JDeveloper/IDS Oracle

PR:3- COMPUTER NETWORKS LAB

L	T	P	Total Marks = 50	Course Code: ITPC212/PR3
0	0	4		Theory Assessment
Total Contact Hrs: 60				End Term Exam: 15
Theory: 0				Progressive Assessment: 35
Tutorial: 0				Category of Course: PC
Practical:60				
Pre-requisite: NIL				
Credit: 2				

RATIONALE:

This course introduces the fundamental concepts of computer networking, covering key topics such as network architecture, protocols, and communication models. It progresses to advanced topics like network security, routing algorithms, and emerging technologies in networking. The course emphasizes the design, implementation, and troubleshooting of networks in real-world scenarios. The goal is to provide students with a comprehensive understanding of how computer networks operate, enabling them to build, manage, and secure efficient communication systems across diverse platforms.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Describe the different types of networks (LAN, MAN, WAN) and understand their respective components (routers, switches, NICs).
- Explain the OSI and TCP/IP models, mapping the corresponding protocols and devices to each layer.
- Perform basic networking tasks such as measuring transmission speeds, configuring cables (Ethernet, UTP, STP), and setting up wireless networks using Wi-Fi devices.
- Analyze the performance characteristics of different network topologies (latency, throughput).
- Design network configurations using various protocols (Ethernet, WLAN, Bluetooth) and network devices (NICs, routers, switches), and troubleshoot issues to ensure seamless communication.

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Showing various types of networking cables and connectors, identifying them clearly	4
II	Looking at specifications of cables and connectors of various companies on Internet, find out differences.	8
III	Making patch cords using different types of cables and connectors - crimping, splicing, etc.	8
IV	Demonstration of different type of cable testers, using them for testing patch cords prepared by the students in Lab and standard cables prepared by professionals	8

V	Configuring computing devices (PC, Laptop, Mobile, etc) for network, exploring different options and their impact – IP address, gateway, DNS, security options, etc	8
VI	Showing various networking devices – NICs, Hub, Switch, Router, WiFi access point, etc.	8
VII	Setting up a small wired LAN in the Lab	8
VIII	Setting up a small wireless LAN in the Lab	8

REFERENCES:

1.	Andrew S. Tanenbaum, Computer Networks, 6th Edition, Pearson India, India, 2022.
2.	Behrouz A. Forouzan, Computer Networks: A Top-Down Approach, 1st Edition, McGraw-Hill Education, India, 2012.
3.	Sanjay Sharma, Computer Networks, 6th Edition, S.K. Kataria & Sons, New Delhi, India, 2013 (Reprint 2022).
4.	Bhushan Trivedi, Computer Networks, 1st Edition, Oxford University Press, India, 2011.
5.	Dr. Bhavana P. Shrivastava & Mr. Ajay Sharma, Basics of Computer Networks, 1st Edition, Mahi Publication, India, 2023.

TH:4(a)- MICROPROCESSOR AND MICROCONTROLLER

L	T	P	Total Marks = 100	Course Code: ITPE202A/ TH4A
3	0	0		Theory Assessment
Total Contact Hrs: 45				End Term Exam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONAL: The course Microprocessor and Microcontroller is designed to explain the concept of single chip computer with minimum hardware peripherals attached to execute programs. The students will understand the configuration of the Intel 8085 and 8086 microprocessors. The student will also learn how to do assembly level programming using these microprocessors including memory and I/O interface. This course will also provide details of microcontroller.

LEARNING OUTCOMES: After completing this course, student will be able to:

- Demonstrate the internal architecture of Microprocessor.
- Demonstrate Assembly Level Language Programming
- Exhibit interfacing with memory, IO and peripheral devices
- Exhibit microcontroller architecture and its instruction set.

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
I	Introduction to Microprocessor • Evolution of Microprocessors, • Specific features of Microprocessors, • Application in our daily life (a few examples)	3
II	Internal architecture of a microprocessor (using block diagram) • Explanation of each block in brief, • Concept of bus structure, • Register-to-register transfer, • Communication with I/O and memory (This part can be explained using the specific microprocessors like 8085 or 8086/8088). • Pin details of 8085 and 8086/8088 CPU and their functions in brief	6

III	Addressing modes in general (may be limited to 8085 and 8086/8088 CPU) • Instruction cycles, • Instruction set, • timing diagram (may be limited to 8085 and 8086/8088 CPU). Concept of assemblers and compilers	4
IV	Interfacing of Memory and I/O devices • Concept of address space, address/data bus demultiplexing, • Address and data bus buffering, address decoding, • I/O concepts, • Memory interfacing concept of I/O mapped I/O and memory mapped I/O. • Interrupts - Types of interrupts, Hardware and software data transfer schemes - Synchronous, asynchronous and interrupt driven.	5
V	Assembly Language Programming: (This part may be limited to the use assembly language of 8085 or 8086/8088 CPU) • Example for register to register, register to memory, memory to register, block of data movement from one area of memory to another, merging of two blocks of data, data block exchange. • Examples of arithmetic addition, subtraction, multiplication and division • Examples of searching and sorting (simple) • Examples using of look up tables • Use subroutines and delay programme.	10
VI	Peripheral chips and their Interfacing: • Functional description of 8255, 8253, 8251, 8257, 8237 and 8259. • Interfacing of these chips with some standard CPU. • Simple assembly language programme to explain the function of these chips.	6
VII	Special Purpose Interfacing Devices and their Interfacing : • Keyboard interfacing, • 7 segment and dot matrix display interfacing, • A/D and D/A interfacing, • Stepper motor interfacing	4
VIII	Microcontroller • Introduction to 8051 Microcontroller • 8051 Instruction Set and Programming • Hardware features of 8051 • Example of 8051 Interface	7
Total		45

REFERENCE BOOKS:

1. Microprocessor and Interfacing by Douglas V. Hall and SSSP Rao 3rd Edition TMH
2. Microprocessor by Ramesh S. Gaonkar, PHI
3. Introduction to Microprocessor – by A.P. Mathur, TMH
4. IBM PC & Clones by Govindraju, TMH
5. Microprocessor and Microcontroller by M. Senthil Kumar, M. Saravanan, S Jeevanathan, 2nd Edition, Oxford Higher Education.
6. Computer Organization & Architecture by Willam Stallings, PHI

TH:4(b)- COMMUNICATION THEORY

L	T	P	Total Marks = 100	Course Code: ITPE202B/TH4B
3	0	0		Theory Assessment
Total Contact Hrs: 45				End Term Exam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONAL: Electronic communication is the exchange of data and messages over a network or electronic means. It has many uses, including business, education, recreation, and personal communication. This course concentrates on brief overview on analog and digital communication and to teach students about the basic principles underlying the operation and design of a communication system.

LEARNING OUTCOMES: After completing this course, student will be able to:

- Explain the basic requirements of an analog communication system;
- Discuss analog modulation including PAM, PWM and PPM;
- Illustrate the functioning of transmitter and receiver;
- Explain the difference between digital and analog communication;
- Design a communication system

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
I	Elements of Communication Systems • Communication Process • Concept of Elements of Communication System & its Block diagram • Source of information & Communication Channels • Classification of Communication systems • Modulation Process • Need of modulation and classify modulation process • Analog and Digital Signals & its conversion. • Basic concept of Signals & Signals classification (Analog and Digital) • Bandwidth limitation	8
II	Linear Modulation • Concept and necessity of modulation • Definition of amplitude, frequency and phase modulation • Explanation of Amplitude modulation • AM equation, Modulation Index, • Spectrum of AM signal, • Power relation, • AM generation and detection	9

III	Angle Modulation • Frequency modulation basic • FM equation, Modulation index, frequency deviation • NBFM, WBFM • Spectrum of FM, Bandwidth of FM • Phase modulation basic • Comparison of FM and PM • Methods of FM Generation (Indirect (Armstrong method only) working principle with Block Diagram • Methods of FM Demodulator or detector (Forster-Seely & Ratio detector)- working principle with Block Diagram	10
IV	Discrete and Digital Modulation Techniques • Idea of Sampling, Sampling theorem • Multiplexing- TDM, FDM • PAM, PWM, PPM – generation & detection • Pulse Code Modulation • Differential PCM • Delta Modulation • ASK, FSK, PSK • Application of Different Modulation Schemes • Types of Modem & its Application	10
V	Demodulation and Receiving System: • Principle of detection with diode detector • AGC circuit delayed AGC • Foster-Seeley discriminator – Ratio Detector – Limiter – Standard AFC Circuits (basic principles only, no derivation) • Block diagram and principle of operation of super heterodyne receiver • Basic Principle and types of antenna., Examples of antenna, antenna on a computer.	8
Total		45

REFERENCE BOOKS:

1. Electronic Communication System, Kennedy Tata McGraw-Hill
2. Communication system, Chandrasekhar OXFORD
3. Analog and Digital communication, B.P. Lathi OXFORD
4. Electronic Communication, Roddy Coolen Prentice Hall of India, N. Delhi
5. Principles of communication Engg., .Anokh Singh, AK Chabaria and S Chand
6. Analog and digital Communication, Sanjay Sharma S.K. Kataria
7. Electronics Communication, Frenzel Tata McGraw-Hill

TH:4(c)- INFORMATION THEORY AND CODING TECHNIQUES

L	T	P	Total Marks = 100	Course Code: ITPE202C/ TH4C
3	0	0		Theory Assessment
Total Contact Hrs: 45				End Term Exam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONAL: Information communication over electronic communication channels has their own challenges. There are chances of information being eavesdropped, corrupted, lost and spoofed during communication. Information Theory and Coding Techniques have discussed the sound and time-tested methods for preventing these incidents.

LEARNING OUTCOMES: After completing this course, student will be able to:

- Explain information, quality of Information, and Information entropy,
- Demonstrate the working principles and design of AES, DES,
- Demonstrate various coding techniques like Arithmetic Encoding, Huffman Encoding, Hamming Code, Gray code, Lempel Ziv, JPEG Encoding Standard, etc., and
- Demonstrate the applications of coding techniques in Networking and Communication

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
I	Introduction to Information Theory: • Entropy of Information, • Fundamentals of Information System, • Types of Information System, • Coding Theory, • Types of Coding Techniques.	8
II	Entropy Encoding Techniques: • Arithmetic Encoding, • Huffman Encoding, • Lempel Ziv Encoding, • Run Length Encoding	12
III	Coding Techniques for Error Detection and Correction: • Hamming (7,4) Code, • Hamming (15, 11) Code, • Hamming (31, 26) Code, • Gray Code, • Excess-3 Code	10

IV	Introduction to Information Security: • Principles of Security, • Implementation of Security Protocols, • Network Security, • Network Security Model	8
V	Cryptography and Steganography: • DES, AES, RSA Algorithms. • Introduction to Steganography	7
Total		45

REFERENCE BOOKS:

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, 2ed, Wiley Publication
2. Principles of Information Security by Michael E. Whitman, Herbert J. Mattord 7th Edition Cengage Learning Publisher, 2021,
3. Cryptography and Network Security: Principles and Practice, by By William Stallings, Global Edition 2022, Pearson Education.
4. Information Theory and Coding by by Murlidhar Kulkarni, K.S. Shivaprakasha, Wiley Publication

TH:5(a)- JAVASCRIPT

L	T	P	Total Marks = 100	Course Code: ITPE204A/ TH5A
3	0	0		Theory Assessment
Total Contact Hrs: 45				End Term Exam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONAL: This course has been designed for student so that they can use JavaScript language for the Web Development. The student will develop concept of JavaScript language and will be able to develop elementary program using various construct of JavaScript Language.

LEARNING OUTCOMES: After competing this course, student will be able to:

- Explain the basic concept about the JavaScript language
- Demonstrate the various concept of Web Page development using JavaScript
- Exhibit the concept of Object-Oriented Programming using JavaScript
- Exhibit the concept of React and Angular

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
I.	Introduction To HTML, CSS and JavaScript • Introduction to web development (HTML, CSS, JavaScript). • Setting up the development environment (text editors, browsers, developer tools). • Basic HTML structure and tags. • CSS for styling web pages (selectors, properties, values).	5
II.	Basics of JavaScript • Variables, data types (numbers, strings, Boolean, arrays, objects). • Operators (arithmetic, comparison, logical, assignment). • Expressions in JavaScript • Control flow statements (if-else, switch, for, while). • Functions (defining, calling, parameters, return values).	5
III.	Web Development using JavaScript • Introduction to Document Object Module (DOM) • Use of DOM in HTML and CSS webpages • Event Handling	6

	• Handling of User Interactions and Events • Form Validation on the Web Page • Creation of Dynamic Content for Web Page using JavaScript	
IV.	Advanced JavaScript • Objects and Prototypes • Closure • Asynchronous programming techniques like callbacks, promises, and async/await • Working with APIs (Fetch API). • Error handling (try-catch). Introduction to ES6+ features (let, const, arrow functions, destructuring, spread operator, modules).	10
V.	Introduction to React • Introduction to React and its features. • Setting up a React development environment. • JSX syntax. • Components (functional and class components). • Props and state. • Event handling in React. • Lifecycle methods. • Working with forms.	9
VI.	Advanced React • Routing in React (React Router). • State management (Context API, Redux - introduction). • Working with APIs in React. • Testing React components (Jest, Enzyme - introduction). • Deployment of React applications. • Introduction to React Hooks.	5
VII.	Introduction to Angular • Introduction to Angular and its features. • Setting up an Angular development environment. • Components, Modules, and Templates. • Data Binding and Directives. • Services and Dependency Injection. • Routing in Angular. • Forms in Angular (Template-driven and Reactive forms).	5
Total		45

REFERENCE BOOKS:

1. JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language by David Flanagan, 7th Edition, SPD O'Reilly Publisher
2. JavaScript Masterclass: A comprehensive guide to mastering JavaScript programming by Yenko Belov, BPB Publications
3. Eloquent JavaScript by Marijn Haverbeke, 3rd Edition, No Starch Press
4. JavaScript Absolute Beginner's Guide - No Experience Necessary, by Kirupa Chinnathambi, 3rd Edition, Pearson Education.
5. The Road to learn React by Robin Wieruch, Zaccheus Entertainment
6. Learning React – Modern Pattern for Development React Apps by Alex Banks and Eve Porcello 2nd Edition, O'Reilly Media
7. Angular Up and Running – Learning Angular Step by Step by Shyam Seshadri, Shroff Publishers and Distributors (SPD)

TH:5(b)- PROGRAMMING in C++

L	T	P	Total Marks = 100	Course Code: ITPE204B/TH5B
3	0	0		Theory Assessment
Total Contact Hrs: 45				End Term Exam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONAL: This course has been designed for the students to develop the concept related to Object-Oriented Programming by using C++ language. The course will elaborate the concept related to classes and objects, operator and function overloading, inheritance and polymorphism and related concepts.

LEARNING OUTCOMES: After completing this course, student will be able to:

- Explain the basic concept about Object-Oriented Programming
- Demonstrate concepts related to Objects and Classes
- Exhibit Inheritance and Polymorphism
- Exhibit Operator and Function Overloading

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
I.	Introduction To Object Oriented Programming • Introduction to object-oriented approach • Need of object-oriented programming	2
II.	Features of Object-Oriented Language C++ • Common statement • Basic data types • Operators • Arithmetic, relational, logical operators • Manipulators, assignment and conditional operators • New and delete operators • Control structure • FOR loop • WHILE loop • If-else statement • Switch statement • Break and continue statement	7

III.	Objects and Classes • Definition and declaration • Access specifier: Private, Public and Protected • Constructor and Destructor • Classes and Instances of classes	9
IV.	Operator Overloading • Basic concepts of overloading • Overloading unary operators • Overloading binary operators • Advantages of operator overloading	6
V.	Inheritance • Definition of inheritance • Basic concepts of “Base class”, “derived class” and “Intermediate Base Class” • Derived class constructor • Public and private inheritance • Types of inheritance: Single, Multiple & Multilevel inheritance • Hierarchical, and Hybrid inheritance,	7
VI.	Polymorphism • Introduction to Polymorphism in C++ programming languages • Types of polymorphism • Polymorphic variables	7
VII.	Function overloading Virtual Functions • Function overloading concepts • Function signature • Call for function with parameters • Definition of virtual function • Friend function and friend classes • Use of ‘this’ pointer	7
Total		45

REFERENCE BOOKS:

1. Object Oriented Programming in C++ by E. Balaguruswamy, 8th Edition, Mc-Graw Hill,
2. Programming in C++ by John R. Hubbard 2nd Edition, (Schaum Series) Mc-Graw Hill,
3. Object Oriented Modeling & Design – by James Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy, William Lorensen, PHI,
4. The C++ Programming Language by Bjarne Stroustrup 4th Edition, Pearson,
5. Let Us C++ by Yashavant Kanetkar, BPB Publication.

TH:5(c)- CLOUD COMPUTING

L	T	P	Total Marks = 100	Course Code: ITPE204C/TH5C
3	0	0		Theory Assessment
Total Contact Hrs: 45				EndTermExam: 70
Theory: 45				Progressive Assessment: 30
Tutorial: 0				Category of Course: PE
Practical: 0				
Pre-requisite: NIL				
Credit: 3				

RATIONALE:

The course on Cloud Computing has been designed to present a holistic view of the Cloud Computing Environment to the students of this programme. This course provides fundamentals concepts related to cloud computing including IT-Resources, Cloud deployment models, benefits and advantages of cloud, risk and challenges of cloud computing and security issues in cloud computing environment.

LEARNING OUTCOMES: After completing this course, student will be able to:

- Explain the fundamentals concepts of cloud computing,
- Exhibit the basic terminology of cloud computing,
- Demonstrate various cloud computing models,
- Explain technology and security related to cloud environment,
- Exhibit cloud service management,
- Explain security related to cloud environment.

DETAILED COURSE CONTENT:

UNIT NO.	TOPIC / SUB-TOPIC	ALLOTTED TIME (HRS.)
1	Fundamentals of Cloud Computing: Historic background: Technological Innovation- Clustering, and Grid Computing, Virtualization, Scalability, Availability and Reliability, Replication, Software Defined Networking and Network Function Virtualization. Goals and Benefits of Cloud Computing, Risk and Challenges of Cloud Computing.	4
2	Basics Concepts and Terminology: IT Resource, On-Premises, Cloud Provider Cloud Consumer Cloud Service Owner, Cloud Resource Administrator	3
3	Cloud Concepts and Models: Characteristics of Cloud Computing Cloud Delivery Models – SaaS, PaaS, IaaS. Cloud Deployment Model – Private, Public, Community and Hybrid Deployment Model	8

4	Technology related to Cloud Computing: Virtualization Technology, Data Centre Technology, Web Technology, Multitenant Technology, Service Technology, Broadband and Internet Architecture.	10
5	Cloud Services and Platforms: Compute Service- Amazon EC2, Google Computer Engine, Windows Azure Virtual Machine. Storage Service- Amazon Simple Storage Service, Google Cloud Storage, Windows Azure Storage Application Services – Email Service, Media Service, Application Runtime and Framework. Identity and Access Management System-Azure Active Directory	7
6	Hadoop and MapReduce: Apache Hadoop MapReduce Job Execution, Hadoop Schedulers Hadoop Cluster Set-up	4
7	Cloud Security: Basics of Security – Confidentiality, Integrity, Availability, Authentication, C Encryption, Assets, Vulnerability, and Threats, Risk and Risk Management, Threat Agents Cloud Security Threats Additional Consideration of Cloud Security - Security Policy Disparity, and Flawed Environment.	6
8	Cloud Management: Remote Administration System Resource Management System Service Level Agreement (SLA) Management System, Billing System	3
Total		45

REFERENCE BOOK:

1. Cloud Computing: Concepts, Technology C Architecture by Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Pearson Education
2. Cloud Computing: A Hands-on Approach, by Arshdeep Bagha and Vijay Madiseti, Universal Press (India) Pvt. Ltd.
3. Cloud Computing by Shailendra Singh, Oxford University Press.
4. Cloud Computing: Architecting Next-Gen Transformation Paradigms by Kumar Saurabh, Wiley India Pvt Ltd.

PR:4- MINOR PROJECT

L	T	P	Total Marks =100	Course Code: PR202
0	0	4		Theory Assessment
Total Contact Hrs: 60				End Term Exam:30
Theory: 0				Progressive Assessment: 70
Tutorial: 0				Category of Course: Mandatory course
Practical: 60				
Pre-requisite: NIL				
Credit: 2				

RATIONALE: A Minor project generally requires a larger amount of effort and more independent work than that involved in a normal assignment. It requires students to undertake their own fact-finding and analysis. The students will select the topic, perform and design work. Minor project is as preparation for the students to take on more responsibilities and bigger project in the future. It is a learning experience, which aims to provide students with the opportunity to synthesize knowledge from different areas of learning, and critically and creatively apply it to real life situations. The leadership quality, co-ordination of job and maintaining good communal harmony is an important factor of this type of activity.

LEARNING OUTCOMES: After completion of the course, the students will be able to

- Plan a Minor Project
- Execute a Minor Project with team.
- Implement hardware/software/analytical/numerical techniques, etc. based on project requirements.
- Optimize time related works through sharing of work responsibility
- Develop cost awareness and utilisation of fund.
- Prepare a technical report on the project.

GUIDELINES FOR MINOR PROJECT

O	Minimum three and maximum five students can form a group for the minor project.
O	Project type can include ☐ Development of a simple prototype system/product. ☐ Investigation of performance of some systems using experimental method Analysis of ☐ components/systems/devices using suitable software Investigation of optimum process/material for ☐ product development using market survey. ☐ Solution for society/industry problems
Project domain may not be limited to the specific area / discipline.	
Project report to be prepared and submitted by the students with following components: 1) Title 2) Objectives 3) Relevance and significance 4) Methodology 5) Analysis-Simulation/experimentation/survey/testing etc. 6) Result and Discussion 7) Conclusion	

ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P	Total Marks = 0	Course Code: AU202
2	0	0		Theory Assessment
Total Contact Hrs: 30				End Term Exam: 0
Theory: 30				Progressive Assessment: 0
Tutorial: 0				Category of Course: Mandatory course
Practical: 0				
Pre-requisite: NIL				
Credit: 0				

RATIONALE: Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make them understand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

LEARNING OUTCOMES: After completion of the course, the students will be able to:

- Discuss the concepts of traditional Indian knowledge and roots of knowledge system and indigenous knowledge system
- Explain the technique of protection of traditional Indian knowledge
- Discuss legal frameworks of traditional knowledge
- State intellectual property rights
- State traditional knowledge in Different Sectors

DETAILED COURSE CONTENTS:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Odisha.	7
II	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	7

III	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	6
IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	4
V	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	6

REFERENCES:

1.	Cultural Heritage of India- Course Material by V. Sivaramakrishna Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2.	Modern Physics and Vedant by Swami Jitatmanand, Bharatiya Vidya Bhavan.
3.	The wave of Life by Fritzof Capra
4.	Tao of Physics by Fritzof Capra
5.	Tarkasangraha of Annam Bhatta, International by V N Jha Chinmay Foundation, Velliand, Amaku,am
6.	Science of Consciousness Psychotherapy and Yoga Practices by RN Jha Vidyanidhi Prakasham, Delhi, 2016

ANNEXURE I

Specification of the Multimedia Desktop	
Item	Specification
Processor	12th Generation Intel Core i7-12700 Processor with 12 core, 25 MB Cache, base clock speed of 2.1 GHz or higher.
Chipset	Intel Q670/H670 or equivalent chipset with the above processor
Motherboard	Motherboard make from the same Desktop OEM (OEM Logo must be embossed in the motherboard)
Memory	16GB 4800 MHz DDR5 or higher, Expandable up to minimum 64 GB DDR5- 4800 MHz or higher
SSD	512 GB NVMe
Monitor	21.5 inches with LED Backlight or higher with 1920 x 1080 Monitor stand capable of Height adjustment option, Including Internal speaker (Same Desktop OEM make).
Ethernet	Integrated Gigabit (10/100/1000) NIC
Mouse	2 Button USB Optical Scroll Mouse (Same OEM make/brand as system)
Keyboard	104 Keys USB keyboard (Same OEM make/brand as system)
Graphics	Integrated Graphics / NVIDIA GTX 1060 (6GB DDR6)
Audio	Internal audio connector with Internal audio Speaker
I/O Ports (all ports must be embedded in the mother board no external adaptor will accepted)	8 or more USB (at least 4 USB V3.0 or higher)
	1 Ethernet (RJ45)
	1 VGA / 1 Display port
	1 Stereo line in/out
	1 HDMI port
	Wi-Fi and Bluetooth
Expansion Slots	Minimum 4 PCI/PCIe slots, 2 x M.2 slots.
	USB & Network Enable/Disable Port Control
	Power-On Password
Chassis	Tower with Chassis volume 13 to 26 liters.
Bays	1 internal 3.5" and 1 internal 2.5"
Power Supply	Minimum 260 Watt with 90% or higher energy efficient power supply
Operating System & Media	Windows 11 Professional 64 Bit. with OEM self-Declaration on Microsoft Pre-loaded operating systems from OEM factory. The Quoted Model Hardware Drivers must be available in OEM website for easy download. Latest Service Pack Preloaded License, OEM Media in form of DVD/CD/USB containing drivers and operating systems. Or Ubuntu Linux latest version
OS Certifications, Compatible	Windows 11 Professional and Ubuntu Linux Certification for the quoted model.

Warranty	5 years On-site Comprehensive OEM Warranty (OEM supplied model Warranty must be visible in OEM website in respect to each product serial number)
Manufacturer Criteria	Minimum 10 Years presence in India. OEM letter confirming that service request would be placed directly with the Desktop OEM for the duration of warranty.
Peripherals / Additional components:	
Speakers	Stereo Computer Speakers of Good make with 3.5 mm jack / 2.1 Speakers Computer speakers with 3.5 mm jack
Web Cam	USB HD 720 Web CAM with microphone

Specification of LAPTOP	
Item	Specifications
Processor	Intel® Core™ i7-1255U (1.7 GHz base frequency, 12 MB L3 cache, 10 cores) or higher
Chipset	Integrated Chipset
Memory	16 GB DDR4 RAM, 3200 MHz or higher, upgradable to 32 GB, at least 1 DIMM slot should be vacant for upgradation.
Hard Disk Drive	512 GB SSD
Display	14"/15.6" LED HD display
Ethernet Interface	Integrated Ethernet 10/100/1000 NIC
Wireless & Bluetooth	Intel Dual Band Wi-Fi 6 AX201 and Bluetooth 5.0 or higher
Keyboard	Standard backlit keyboard with Integrated Touchpad
Graphics	Dedicated 2 GB (AMD/NVIDIA)
Ports and Connectors	4 USB ports out of which at least 2 port USB 3.1 and 1 port USB 3.1 Type C / Thunder Bolt Port , 1 HDMI, 1 RJ-45/Ethernet, 1 AC power, 1 Headphone/ microphone combo jack
Weight	Maximum 1.60 KG, same should be mentioned in OEM brochure
Speaker, Microphones and Webcam	Integrated dual stereo speakers, Integrated dual array microphone, Integrated HD webcam
Battery Backup	40-watt hour or better
Operating System	Preloaded Microsoft Windows 11 Professional 64 bit with Installation Media (DVD/CD/USB), (Latest & Stable Version)
OS Certifications	Must be certified for Windows
AC Adapter	Standard Indian Adaptor
Carry Bag	Good quality Same OEM back pack with OEM logo
Mandatory Certifications	UL, FCC Compliance, Energy Star , EPEAT Gold
Warranty	5 Years On-site Comprehensive OEM Warranty/Guarantee with NBD support.

List of Contributors for Curriculum of Information Technology

Faculty Members from SCVETE, Odisha:

1. Dr. Anita Rani Brahma, Sr. Lecturer, Information Technology, Govt Polytechnic
2. Kumari Jyoti, Sr. Lecturer, Information Technology, Govt Polytechnic
3. Dr. S. Beura, Sr. Lecturer, Information Technology, Govt Polytechnic

Faculty Members from NITTTR, Kolkata

1. Dr. Rajeev Chatterjee, Associate Professor, CSE (Curriculum Coordinator)
2. Dr. Indrajit Saha, Assistant Professor, CSE (Group Coordinator)

Industry Expert:

1. Dr. Sadhu Prasad Kar, Enterprise Architect, Tech Mahindra, Kolkata