

RCOEM

**Shri Ramdeobaba College of
Engineering and Management, Nagpur**

**SHRI RAMDEOBABA COLLEGE OF
ENGINEERING AND MANAGEMENT,
NAGPUR – 440013**

**An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University
Nagpur, Maharashtra (INDIA)**

PROGRAMME SCHEME

2023-2024

**B. TECH. (INFORMATION TECHNOLOGY)
(NEP)**

Teaching Scheme for B.Tech. Information Technology

Semester - I											
Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	BSC	PHT 1006	Introduction to Quantum Computing	2	1	0	3	50	50	100	03 Hrs
2	BSC	PHP 1006	Introduction to Quantum Computing Lab	0	0	2	1	50	-	50	-
3	BSC	MAT1002	Calculus	3	0	0	3	50	50	100	03 Hrs
4	BSC	MAP1002	Computational Mathematics Lab	0	0	2	1	50	-	50	-
5	ESC	ITT1001	Fundamentals of Programming	2	1	0	3	50	50	100	03 Hrs
6	ESC	ITP1001	Fundamentals of Programming Lab	0	0	2	1	50	-	50	-
7	ESC	ITT1002	Digital Circuits	2	1	0	3	50	50	100	03 Hrs
8	ESC	ITP1002	Digital Circuits Lab	0	0	2	1	50	-	50	-
9	PCC	ITP1003	IT Workshop Lab	0	0	2	1	50	-	50	-
10	HSSM-AEC	HUT1002	English for Professional Communication	2	0	0	2	50	50	100	03 Hrs
11	HSSM-AEC	HUP1002	English for Professional Communication Lab	0	0	2	1	50	-	50	-
12	HSSM-VEC	HUT1004	Foundational course in Universal Human Value	1	0	0	1	50	-	50	-
13	CCA	PEP1002	Liberal/Performing Art	0	0	2	1	50	-	50	-
Total				12	3	14	22	650	250	900	

Semester - II											
Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total Marks	ESE Duration
1	BSC	CHT2006	Chemistry of Smart Materials	2	0	0	2	50	50	100	02 Hrs
2	BSC	CHP2006	Chemistry of Smart Materials Lab	0	0	2	1	50	-	50	-
3	BSC	MAT2002	Discrete Mathematics	3	0	0	3	50	50	100	03 Hrs
4	ESC	ITT2001	Object Oriented Programming	3	0	0	3	50	50	100	03 Hrs
5	ESC	ITP2001	Object Oriented Programming Lab	0	0	2	1	50	-	50	---
6	PCC	ITT2002	Data Structures	2	1	0	3	50	50	100	03 Hrs
7	PCC	ITP2002	Data Structures Lab	0	0	2	1	50	-	50	
8	VSEC	ITT2003	Creativity, Innovation & Design Thinking	2	0	0	2	50	-	50	-
9	IKS	HUT2001	Foundational Literature of Indian Civilization	2	0	0	2	50	50	100	02 Hrs
10	CCA	PET2001	SPORTS-YOGA-RECRATION	1	0	0	1	50	-	50	-
11	CCA	PEP2001	SPORTS-YOGA-RECRATION LAB	0	0	2	1	50	-	50	-
Total				15	1	8	20	550	250	800	

Exit option: Award of UG Certificate in Major with 42 credits and an additional 8 credits.			
Exit Courses			
1	Introduction to Computer Hardware and Networking	Online/offline Certification Course	8

Semester - III

Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT3001	Computer Organization and Architecture	3	0	0	3	50	50	100	03 Hrs
2	PCC	ITT3002	Design and Analysis of Algorithms	2	1	0	3	50	50	100	03 Hrs
3	PCC	ITP3002	Design and Analysis of Algorithms Lab.	0	0	2	1	50	-	50	-
4	VSEC	ITP3003	IT Infrastructure Services Lab.	0	1	2	2	50	-	50	-
5	MDM	MAT3002	Probability and Statistics	3	0	0	3	50	50	100	03 Hrs
6	OE	ITT2980	Open Elective -I	2	0	0	2	50	50	100	02 Hrs
7	HSSM-AEC	HUT3001	Business Communication	2	0	0	2	50	50	100	02 Hrs
8	HSSM-VEC	HUT3002	Environmental Education	2	0	0	2	50	50	100	02 Hrs
9	CEP/FP	ITP3005	Field Project	0	0	4	2	25	25	50	-
TOTAL				14	2	8	20	425	325	750	

Course Code	Open Elective-I
ITT2980-1	Web Development

Semester - IV

Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT4001	Formal Languages and Automata Theory	2	1	0	3	50	50	100	03 Hrs
2	PCC	ITT4002	Database Management System	2	1	0	3	50	50	100	03 Hrs
3	PCC	ITP4002	Database Management System Lab	0	0	2	1	50	-	50	-
4	PCC	ITT4003	Software Engineering	2	1	0	3	50	50	100	03 Hrs
5	PCC	ITP4003	Software Engineering Lab	0	0	2	1	50	-	50	-
6	VSEC	ITP4005	Software Tools	0	0	4	2	50	-	50	-
7	HSSM-VEC	ITT4006	Cyber Laws and Ethics	2	0	0	2	50	50	100	02 Hrs
8	MDM	MAT4001	Linear Algebra	3	0	0	3	50	50	100	03 Hrs
9	OE	ITT2990	Open Elective -II	3	0	0	3	50	50	100	03 Hrs
10	HSSM-AEC	HUT4003	Managerial Economics (ED/ECO/MGM)	2	0	0	2	50	50	100	02 Hrs
TOTAL				16	3	8	23	500	350	850	

Exit Courses

1	Web Design & Development	Online/offline Certification Course	8
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Course Code	Open Elective-II
ITT2990-1	Mobile App Development

Semester - V											
Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT5001	Compiler Design	3	0	0	3	50	50	100	03 Hrs
2	PCC	ITT5002	Operating Systems	3	0	0	3	50	50	100	03 Hrs
3	PCC	ITP5002	Operating Systems Lab	0	0	2	1	50	-	50	-
4	PCC	ITT5003	Computer Networks	3	0	0	3	50	50	100	03 Hrs
5	PCC	ITP5003	Computer Networks Lab	0	0	2	1	50	-	50	-
6	PEC	ITT5004	Elective -I	3	0	0	3	50	50	100	03 Hrs
7	MDM	ITT5005	Artificial Intelligence	3	0	0	3	50	50	100	03 Hrs
8	MDM	ITP5005	Artificial Intelligence Lab	0	0	2	1	50	-	50	-
9	OE	ITT3980	Open Elective -III	3	0	0	3	50	50	100	03 Hrs
10	HSSM-AEC	HUT5001	Organizational Behaviour	2	0	0	2	50	50	100	02 Hrs
11	ELC	ITP5007	Project-I	0	0	2	1	75	75	150	-
TOTAL				20	0	8	24	575	425	1000	

Course Code	Elective-I
ITT504-01	Customer Relationship Management
ITT504-02	Product and Project Management

Course Code	Open Elective-III
ITT3980-1	Open-Source Technologies

Semester - VI											
Sr. No.	Category		Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT6001	Cryptography and Network Security	3	0	0	3	50	50	100	03 Hrs
2	PCC	ITT6002	Internet and Web Programming	2	1	0	3	50	50	100	03 Hrs
3	PCC	ITP6002	Internet and Web Programming Lab	0	0	2	1	50	-	50	-
4	PCC	ITT6003	Cloud Computing	3	0	0	3	50	50	100	03 Hrs
5	PCC	ITP6003	Cloud Computing Lab	0	0	2	1	50	-	50	-
6	PEC	ITT6004	Elective -II	3	0	0	3	50	50	100	03 Hrs
7	PEC	ITP6004	Elective -II Lab	0	0	2	1	50	-	50	-
8	MDM	ITT6005	Machine Learning	2	1	0	3	50	50	100	03 Hrs
9	MDM	ITP6005	Machine Learning Lab	0	0	2	1	50	-	50	-
10	ELC	ITP6006	Project -II	0	0	4	2	75	75	150	-
TOTAL				13	2	12	21	525	325	850	

Course Code	Elective-II
ITT6004-01/ ITP6004-01	Mobile Apps Development
ITT6004-02 /ITP6004-02	Advanced Java Programming

Exit Courses			
1	Software Project Management	Online/offline Certification Course	8

Semester - VII

Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT7001	Software Architecture	3	1	0	4	50	50	100	03 Hrs
2	PCC	ITT7002	Human Computer Interaction	3	0	0	3	50	50	100	03 Hrs
3	PEC	ITT7003	Elective -III	3	0	0	3	50	50	100	03 Hrs
4	PEC	ITP7003	Elective -III Lab	0	0	2	1	50		50	
5	MDM	ITT7004	Introduction to Deep Learning	3	0	0	3	50	50	100	03 Hrs
6	MDM	ITP7004	Introduction to Deep Learning Lab	0	0	2	1	50		50	-
7	RM	ITT7005	Research Methodology	3	0	0	3	50	50	100	03 Hrs
8	ELC	ITP7006	Project -III	0	0	4	2	75	75	150	-
TOTAL				15	1	8	20	425	375	750	

Course Code	Elective-III
ITT7003-01/ ITP7003-01	Data Warehouse and Business Intelligence
ITT7003-02/ ITP7003-02	Digital Forensics

Semester - VIII											
Sr. No.	Category	Course Code	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	PCC	ITT8001	Cyber Physical Systems	3	0	2	3	50	50	100	03 Hrs
2	PCC	ITP8001	Cyber Physical Systems	0	0	2	1	50	-	50	-
3	PEC	ITT8002	Elective -IV	4	0	0	4	50	50	100	03 Hrs
4	PEC	ITT8003	Elective -V	3	0	2	3	50	50	100	03 Hrs
5	PEC	ITP8003	Elective -V Lab	0	0	2	1	50		50	
TOTAL				10	0	8	12	250	150	400	

Course Code	Elective-IV
ITT8002-01	Natural Language Processing
ITT8002-02	Blockchain & Cryptocurrency Technologies

Course Code	Elective-V
ITT8003-01/ ITP8003-01	Information Retrieval
ITT8003-02/ ITP8003-02	Social and Information Networks

OR

Sr. No.	Category	Course Title	Lecture	Tutorial	Practical	Credits	Continuous Evaluation	End Sem Exam	Total	ESE Duration
1	ELC	Full Semester Internship/ Research Internship/TBI	0	0	0	12	200	200	400	-

**Scheme of Teaching & Examination of HONOR Specialization
In Information Technology**

Sr. No.	Semester	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs.)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	III	ITTH3100-1	Blockchain and Web3 Programming	3	-	-	3	100	-	100	-.
		ITTH3100-2	NPTEL Course	-	-	-	3	100	-	100	-
02	IV	ITTH4100-1	Development of Progressive Web Applications	3	-	-	3	100	-	100	-
		ITTH4100-2	NPTEL Course	-	-	-	3	100	-	100	-
03	V	ITTH5100-2	Cloud Native Apps Development	4	-	-	4	100	-	100	-
		ITTH5100-2	NPTEL Course	-	-	-	4	100	-	100	-
04	VI	ITTH6100-1	Introduction to DevOps	4	-	-	4	100	-	100	-
		ITTH6100-2	NPTEL Course	-	-	-	4	100	-	100	-
05	VII	ITPH7100	Project	-	-	08	4	50	50	100	-
Total				14	-	08	18	-	-	500	

**The Scheme of Teaching & Examination of MINOR Specialization
In Information Technology**

Sr. No.	Semester	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs.)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	III	ITTM3100-1	Web Designing	2	1	-	3	50	50	100	03 Hrs.
		ITTM3100-2	NPTEL Course	-	-	-	3	100	-	100	-
02	IV	ITTM4100-1	Advanced Java Programming	2	1	-	3	50	50	100	03 Hrs.
		ITTM4100-2	NPTEL Course	-	-	-	3	100	-	100	-
03	V	ITTM5100-1	Data Warehousing and Business Intelligence	3	1	-	4	50	50	100	03 Hrs.
		ITTM5100-2	NPTEL Course	-	-	-	3	100	-	100	-
04	VI	ITTM6100-1	Introduction to Emerging Technologies	3	1	-	4	50	50	100	03 Hrs.
		ITTM6100-2	NPTEL Course	-	-	-	3	100	-	100	-
05	VII	ITTM7100	Project	-	-	8	4	50	50	100	-
Total				10	04	08	18	-	-	500	

Syllabus for B. Tech. I Semester
Department of Information Technology

Course Code	PHT 2001/1006				
Category	Basic Science Course				
Course Title	Introduction to Quantum Computing (Theory)				
Scheme & Credits	L	T	P	Credits	Semester I / II
	2	1	0	3	

Course Objectives

1. To introduce the fundamentals of quantum computing to students
2. The problem-solving approach using finite dimensional mathematics

Course Outcomes

After successful completion of the course, the students will be able to -

1. Use the basic quantum theory relating to the probabilistic behaviour of an electron in an atom.
2. Utilize the knowledge of complex vector space in the domain of quantum theory.
3. Analyse classical and quantum approach towards the quantum computation.
4. Classify deterministic and probabilistic systems and analyse quantum observations and quantum measurements.
5. Use quantum gates in building architecture and quantum algorithms.

Module 1: Basic Quantum Theory

Brief introduction about Quantum Computers and Quantum mechanics, Wave nature of Particles, Bohr's quantization condition, Heisenberg's Uncertainty principle, Wave function, probability, Schrodinger's wave equation, Operators, Electron in an infinite potential well, Eigen value and Eigen functions.

Module 2: Complex Vector Spaces

Algebra and Geometry of Complex numbers, Real and Complex Vector Spaces, definitions, properties, Abelian group, Euler's formula, De Moivre's formula, Matrix properties.

Module 3: Linear Algebra in Quantum Computing

Basis and Dimensions, Inner products, Hilbert Spaces, Eigenvalues and Eigenvectors, Hermitian and Unitary Matrices, Tensor Product, Applications of linear algebra in computer graphics.

Module 4: Classical and Quantum Systems

Deterministic and Probabilistic Systems, Quantum Systems, Stochastic billiard ball, Probabilistic double slit experiment with bullet and photon, Superposition of states, assembling systems, Entangled states.

Module 5: Quantum representation of systems

Dirac notations, Stern-Gerlach experiment, transition amplitude, norm of the ket, Bloch Sphere, Observables, Spin matrices, commutator operator, expectation values, variance, standard deviation, Heisenberg's uncertainty principle in matrix mechanics, measuring, dynamics, observations.

Module 6: Architecture and Algorithms

Bits and Qubits, Classical Gates and their equivalent quantum representation, Reversible Gates: CNOT, Toffoli, Fredkin, gates, outline of Pauli X, Y, Z gates, Hadamard gates, Deutsch Gate.

Quantum Algorithms: Deutsch's algorithm, Grover's search algorithm.

Applications of quantum computing in Cryptography, Quantum teleportation, Cybersecurity, banking, finance, advance manufacturing and artificial intelligence.

Text Book

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
2. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

Reference Books

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008
2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

Syllabus for B. Tech. I Semester
Department of Information Technology

(Cyber Security, Artificial Intelligence and Machine learning, Data science, Computer Science and Engineering and Information Technology)

Course Code	PHP 2001/1006				
Category	Basic Science Course				
Course Title	Introduction to Quantum Computing Lab				
Scheme & Credits	L	T	P	Credits	Semester I / II
	0	0	2	1	

Course Outcomes:

The physics laboratory will consist of experiments and programming exercises illustrating the principles of quantum physics and quantum computing relevant to the study of computer science and engineering.

On completion of the course, the students will be able to

1. Develop skills required for experimentation and verification of physics laws.
2. Utilise Mathematica software for graph plotting and for least squares fitting of the experimental data.
3. Compare the properties of real and complex matrices with reference to their use in quantum system.
4. Apply the computational methods to solve eigenvalues and eigenfunctions, tensor products.
5. Simulate classical and quantum gates.

List of Experiments:

1. Introduction to IBM quantum computer.
2. Simulation of classical gates by quantum representation of the gates and inputs.
3. Arithmetic operations using IBM Quantum computer.
4. Simulation of quantum gates: CNOT gate, Toffoli gate, Fredkin gate, Hadamard gate on IBM quantum computer.
5. Linear and Nonlinear data fitting by least squares fit method
6. Working with Vectors.
7. Working with Matrices: Real and Complex numbers.
8. Eigen values, Eigen functions, Properties of Inner Product and Unitary Matrices, Tensor Product.
9. Verification of Ohm's law and error analysis of the data using Linear Least Square Fit (LLSF) method.
10. Analysis of energy values and wavefunction using Mathematica software

Reference Books

1. Lab manual prepared by Physics Department, RCOEM, Nagpur

Syllabus for B. Tech. I Semester

Department of Information Technology

Course Code	MAT1002				
Category	Basic Science Course				
Course Title	Calculus				
Scheme & Credits	L	T	P	Credits	Semester I
	3	0	0	3	

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, student shall be able to

1. Apply the concepts of continuity and differentiability to find Taylor's and Maclaurin series.
2. Understand the methods of partial derivatives and apply these concepts to determine extreme values of the functions of two variables.
3. Demonstrate the basic knowledge of vector differentiation and line integral.
4. Understand proper and improper integrals and use it find area, length, volume and surface of revolution
5. Internalize convergence of sequences and apply it to determine whether infinite series convergent or divergent with appropriate tests.

Syllabus

Module 1 : (8 Lectures)

Differential Calculus: Functions of single variable: Review of limit, continuity and differentiability. Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem, Taylor's and Maclaurin series.

Module 2: (8 Lectures)

Partial Differentiation: Partial derivatives, Euler's Theorem, chain rule, total derivative, Jacobians, Maxima, Minima for the functions of two variables.

Module 3: (8 Lectures)

Vector Calculus: Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, Line integral.

Module 4: (8 Lectures)

Integral Calculus: Fundamental theorem of Integral calculus, mean value theorems, evaluation of definite integrals, applications in area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions.

Module 5: (8 Lectures)

Infinite series: Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, uniform convergence, power series, radius of convergence.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

Syllabus for B. Tech. I Semester
Department of Information Technology

Course Code	MAP1002				
Category	Basic Science Course				
Course Title	Computational Mathematics Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Objectives:

The computational Mathematics Lab course will consist of experiments demonstrating the principles of Mathematics relevant to the study of Science and Engineering. Students will show that they have learnt Laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. On successful completion of the course students shall be able to:

Course Outcomes:

By using open source software SageMath Students will be able to

CO1: Download SageMath and use it as an advance calculator.

CO2: Sketch and analyze function graphs.

CO3: Apply the concepts of differential calculus to find extreme value of continuous functions and analyze solutions of difference equations

CO4: Evaluate improper integrals and its applications to find length, area, volume, centre of gravity and mass.

CO5: Understand and Analysis Data inscription standards.

CO6: Analyze the data to find best fit curve.

List of Experiments

Exp. No.	Name of Experiments	Mapped COs
1	To use SageMath as advanced calculator	CO1
2	2D Plotting with SageMath	CO2
3	3D Plotting with SageMath	CO2
4	Differential Calculus with SageMath	CO3
5	Solution of difference equations in SageMath	CO3
6	To Learn Cryptography by using SageMath	CO5
7	Curve Fitting by using SageMath	CO6
8	Integral Calculus with SageMath	CO4

Syllabus for B. Tech. I Semester
Department of Information Technology

Course Code	ITT1001				
Category	Engineering Science Course (ESC)				
Course Title	Fundamentals of Programming				
Scheme & Credits	L	T	P	Credits	Semester I
	2	1	0	3	

Course Outcomes

On successful completion of the course student will be able to:

1. Design logic for simple problem statements.
2. Code problem statements involving decision-making and loops
3. Use functions for modular programming
4. Apply the concept of arrays in coding
5. Apply the concept of structures in coding
6. Perform file operations

Unit I: Introduction to components of a computer system, Algorithm and Flowchart for problem-solving.

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Decision Control Statement- if and Conditional operators.

Unit II: Switch case statement, Loops, Pre-processor Directives.

Unit III: Concept of functions, User defined and Library Functions, parameter passing, Recursion, Storage class, Pointers.

Unit IV: Arrays: 1-D, 2-D, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Pointers to the array, Command line arguments.

Unit V: Structures, Simple structures, Array of Structures

Unit VI: File handling Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush ().

Text Books

1. Programming in ANSI C: E. Balguruswami McGraw Hill
2. Programming in C: B. Gottfried, Second Edition, Schaum Outline Series, Tata Mc-Graw Hill Publishers, 1996
3. The C Programming Language: B. W. Kernighan and D. M. Ritchie, Second Edition, Pearson, June 2015

Reference Books

1. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus for B. Tech. I Semester
Department of Information Technology

Course Code	ITP1001				
Category	Engineering Science Course (ESC)				
Course Title	Fundamentals of Programming Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes

On successful completion of the course student will be able to:

1. Write programs involving decision-making and loops
2. Write programs using arrays
3. Apply the concept of pointers in real-life programming
4. Use structures to code complex problems
5. Perform operations on files.

Practical No.	Description
1	Program to demonstrate the use of different data types
2	Program to demonstrate the use of decision control statement
3	
4	Program to demonstrate the use of Loops
5	
6	Program to demonstrate the use of functions and Recursion
7	
8	Program to demonstrate the use of Arrays
9	
10	Program to demonstrate the use of pointers
11	Program to demonstrate the use of Structures
12	Program to demonstrate the use of File Handling

Syllabus for B.Tech. Semester I
Department of Information Technology

Course Code	ITT1002				
Category	Engineering Science Course (ESC)				
Course Title	Digital Circuits				
Scheme& Credits	L	T	P	Credits	Semester I
	2	1	0	3	

Course outcomes

Upon completion of the course, students will be able to

1. Minimize Boolean expressions using various techniques.
2. Design combinational circuits using Multiplexers, De-multiplexer, Encoders, Decoders
3. Use Flip Flop as a basic sequential circuit element.
4. Design different memory circuits using PLA and PAL
5. Design Shift registers and Moore –Mealy circuits
6. Design Counters

Unit I :

Number Systems, Logic and Boolean algebra, Logic Gates & Truth Tables, DE Morgan's law, Digital Logic Family, Karnaugh maps, Quine McCluskey minimization technique.

Unit II:

Code Converters, Multiplexers, Demultiplexers, Encoders, Decoders, Adder, Subtractors. Minimization of combinational circuits.

Unit III:

Flip-flops and latches: D, T, S/R, J/K & J/K Master Slave flip-flops, Excitation table, Conversion of one type of F/F to another.

Unit IV:

Introduction to Memory, ROM, RAM, Array of RAM ICs, Read only PLA, PAL Memory.

Unit V:

Registers, Sequential circuit Analysis-Input equations, state table, analysis, and design, Moore & Mealy Circuits.

Unit VI: Counters, asynchronous and synchronous design using state and excitation tables.

Text Books:

1. Modern Digital Electronic: R. P. Jain, Tata McGraw Hill
2. Digital Logic Design: M. Mano, Pearson

Reference Books:

1. Fundamental of Digital Electronics: A. Anand Kumar. PHI

Syllabus for B.Tech. Semester I
Department of Information Technology

Course Code	ITP1002				
Category	Engineering Science Course				
Course Title	Digital Circuits Lab				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes

Upon completion of the course, students will be able to

1. Verify different Boolean laws.
2. Design combinational circuits
3. Design sequential circuits.
4. Design Counters.

Practical No.	Description
Following practical's will be implemented using Verilog Hardware Description Language (VHDL)	
1	Verification of Truth Table of Logic gates
2	Implementation of Logic Gates using universal gates
3	Verification of various Boolean expressions using logic gates
4	Implementation of multiplexer as function generator
5	Implementation of Decoders
6	Implementation of Code converters
7	Implementation of Adders / Subtractor
8	Implementation of Combinational Circuit
9	Implementation of various Flip Flops
10	Implementation of Counters

Syllabus for B.Tech. Semester I
Department of Information Technology

Course Code	ITP1003				
Category	Program Core Course (PCC)				
Course Title	IT Workshop Lab				
Scheme & Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Course Outcomes

Upon completion of the course, students will be able to

1. Use basic functions of MS Excel.
2. Create a Pivot Table report.
3. Use macros in MS Excel.
4. Design static web pages using basic HTML tags.
5. Apply CSS in HTML pages.

Syllabus:

MS Excel:

Introduction to MS Excel. Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler: Gridlines, Format Cells, Summation, auto fill, Formatting Text, Calculating CGPA and insert graphs with all options, Create a PivotTable report. Mail merge using an Excel spreadsheet. Design application

HTML:

HTML Basics: Intro to HTML Syntax, The HTML, head, title, & body tags, Headings, paragraphs, & lists, The strong & em tags, The doctype, The lang attribute, The meta tag & the Unicode character set

Links: Absolute & Relative URLs, Using the width, height, & alt attributes, Using horizontal rules

CSS: Intro to Cascading Style Sheets (CSS), The style tag, Tag selectors, The font size, font-family, color, & line-height properties, Hexadecimal color code

Practical No.	Description
1	Use of various commands in Excel Menu bar
2	Creating excel data sheet and performing various operations
3	Plotting different types of graphs form a data set
4	Apply various filtering techniques on data set
5	Creating Pivot table

6	Applying macro programming on data sheets
7	Creating simple web page using HTML
8	Creating HTML page using List, Table tags
9	Creating HTML page using image tag and image mapping
10	Creating HTML page using CSS

Text Book

1. HTML and CSS: the Complete Reference, Tata McGraw-Hill Education

Syllabus for B. Tech. I Semester

PROGRAM SCHEME & SYLLABUS B. TECH. (INFORMATION TECHNOLOGY) 2023-24 (NEP)

Department of Information Technology

Syllabus and Scheme of English for Professional Communication Theory

Course Code	MAT1002				
Category	Basic Science Course				
Course Title	Calculus				
Scheme& Credits	L	T	P	Credits	Semester I
	3	0	0	3	

Scheme

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum marks	ESE
					Continuous Evaluation	2 hours
HUT1002/2002	English for Professional Communication	I/II	2	2	50	50

Course Objectives

The main objective of this course is to enhance the employability skills of students as well as prepare them for effective work place communication.

Course outcomes:

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate effective use of word power in written as well as oral communication.

CO2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.

CO3. Apply the principles of functional grammar in everyday as well as professional communication.

CO4. Effectively implement the comprehensive principles of written communication by applying various writing styles.

CO5. Create precise and accurate written communication products.

Unit-1: Vocabulary Building

- 1.1 Importance of using appropriate vocabulary
- 1.2 Techniques of vocabulary development
- 1.3 Commonly used power verbs, power adjectives and power adverbs.
- 1.4 Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations

Unit -2: Listening and Reading Comprehension

- 2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening
- 2.2 Reading Comprehension: types and strategies.

Unit -3: Functional Grammar and Usage

- 3.1 Identifying Common Errors in use of: articles, prepositions, modifiers, modal auxiliaries, redundancies, and clichés
- 3.2 Tenses
- 3.3 Subject-verb agreement, noun-pronoun agreement
- 3.4 Voice

Unit-4: Writing Skills

- 4.1 Sentence Structures
- 4.2 Sentence Types
- 4.3 Paragraph Writing: Principles, Techniques, and Styles

Unit-5: Writing Practices

- 5.1 Art of Condensation: Précis, Summary, and Note Making
- 5.2 Correspondence writing techniques and etiquettes – academic writing
- 5.3 Essay Writing

Books

1. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. *Practical English Usage*. Michael Swan. OUP. 1995.
3. *Remedial English Grammar*. F.T. Wood. Macmillan.2007
4. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
5. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
6. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for B. Tech. I Semester
Department of Information Technology

PROGRAM SCHEME & SYLLABUS B. TECH. (INFORMATION TECHNOLOGY) 2023-24 (NEP)

Syllabus and Scheme of English for Professional Communication Practical

Course Code	MAT1002				
Category	Basic Science Course				
Course Title	Calculus				
Scheme & Credits	L	T	P	Credits	Semester I
	3	0	0	3	

Scheme

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum marks
HUP1002/2002	English for Professional Communication Lab	I/II	2	1	50

Course Objective

To enhance competency of communication in English among learners

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

CO1: Apply effective listening and speaking skills in professional and everyday conversations.

CO2: Demonstrate the techniques of effective Presentation Skills

CO3: Evaluate and apply the effective strategies for Group Discussions

CO4: Analyse and apply the effective strategies for Personal Interviews

CO5: Implement essential language skills- listening, speaking, reading, and writing

Syllabus

List of practicals

Computer Assisted + Activity Based Language Learning

Practical 1: Everyday Situations: Conversations and Dialogues – Speaking Skills

Practical 2: Pronunciation, Intonation, Stress, and Rhythm

Practical 3: Everyday Situations: Conversations and Dialogues – Listening Skills

Activity Based Language Learning

Practical 4: Presentation Skills: Orientation & Mock Session

Practical 5: Presentation Skills: Practice

Practical 6: Group Discussions: Orientation & Mock Session

Practical 7: Group Discussions: Practice

Practical 8: Personal Interviews: Orientation & Mock Session

Practical 9: Personal Interviews: Practice

Syllabus for B. Tech. I Semester

Department of Information Technology

Syllabus and Scheme of UHV-1 course

Course Code	HUT1004				
Category	HSSM-VEC				
Course Title	Foundation course in Universal Human Values				
Scheme& Credits	L	T	P	Credits	Semester I
	1	0	0	1	

Course Objectives:

- To help the student see the need for developing a holistic perspective of life
- To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
- To strengthen self-reflection
- To develop more confidence and commitment to understand, learn and act accordingly

Course outcome:

On completion of course, students will be able to achieve the following:

CO1: Develop a holistic perspective of life

CO2: Better understanding of inter-personal relationships and relationship with society and nature.

CO3: An ability to strengthen self-reflection

Syllabus

Unit 1:- Aspirations and concerns

Need for Value Education: Guidelines and content of value education.

Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being

Unit 2:- Health

Harmony of the Self and Body, Mental and physical health; Health for family, friends and society.

Unit 3:- Relationships and Society

Harmony in relationships, Foundational values: Trust, Respect, Reverence for excellence, Gratitude and love; harmony in society; harmony with nature.

Reference Material

The primary resource material for teaching this course consists of

1. Text book: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference books:

- a) B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
- b) PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
- c) Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
- d) Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
- e) Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth*, Club of Rome's Report, Universe Books.
- f) Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
- g) A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.

- h) E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
- i) A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
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HUP0001-1	Fundamentals of Indian Classical Dance: Bharatnatayam	I	2	1	50
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Course objective

The course aims to introduce the students to Bharatnatyam, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self-confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Bharatnataym as an Indian dance form

CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Pratham* (1st level formal exam of Bharatnatayam).

Syllabus

Practical -1: Orientation in Bharatnatayam

Practical-2: Tattu Adavu till 8, Naatta Adavu 4 Steps, Pakka Adavu 1 step, Metta Adavu 1 Step, Kuditta Metta Adavu 4 Steps,

Practical -3: Practice sessions

Practical-4: Tatta Kuditta Adavu (Metta), Tatta Kuditta Adavu (Metta) 2 Steps, Tirmanam Adavu 3 Steps, Kattu Adav - 3 Steps, Kattu Adav - 3 Steps

Practical-5: Practice sessions

Practical-6: Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps,

Practical-7: practice sessions

Practical - 8: final practice sessions and performances.

Recommended reading

1. *Introduction to Bharata's Natyasastra*, Adya Rangacharya, 2011
2. *The Natyasastra and the Body in Performance: Essays on the Ancient Text*, edited by Sreenath Nair, 2015
3. *Bharatanatyam How to ... : A Step-by-step Approach to Learn the Classical Form*, Eshwar Jayalakshmi, 2011

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
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HUP0001-2	Fundamentals of Indian Classical Dance: Kathak	I	2	1	50
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Course objective

The course aims to introduce the students to Kathak, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self-confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Kathak as an Indian dance form

CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give *Prarambhik* (1st level formal exam of Kathak).

Syllabus

Practical -1: Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 count (Bhramari),

Practical -2: practice sessions of practical 1

Practical -3: Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings

Practical -4: practice sessions of practical 3

Practical -5: Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,

Practical -6: practice sessions of practical 5

Practical -7: 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions

Practical -8: Final performances.

Recommended reading

1. Kathak Volume1 A "Theoretical & Practical Guide" (Kathak Dance Book), Marami Medhi & Debasish Talukdar, 2022, Anshika Publication (13 September 2022)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
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HUP0001-3	Introduction to Digital Photography	I	2	1	50
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Course objective

The course aims to develop basic skills of students in digital photography to lay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Develop an understanding of the technical aspects and aesthetics of Photography.

CO2: Apply the rules of digital photography for creating photographs.

CO3: Develop skills to enhance photographs through post processing.

CO4: Create a portfolio of their photographs in selected genre.

Syllabus

Practical 1: **Orientation in digital photography:** Genres, camera handling and settings

Practical 2: **Rules of Composition**

Practical 3: **Rules of Composition:** practice sessions

Practical 4: **Understanding Exposure and Art of Pre-Visualization**

Practical 5: **Rules of Composition and Art of Pre-Visualization:** practice sessions

Practical 6: **Post Processing Photographs and Portfolio creation**

Practical 7: **Post Processing Photographs:** practice sessions

Practical 8: **Portfolio finalization and presentation in selected genre.**

Reference material

1. Scott Kelby (2020) *The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros*, Rocky Nook, USA
2. Larry Hall (2014) *Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography*, Speedy Publishing LLC, Newark
3. J Miotke (2010) *Better Photo Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro*, AMPHOTO Books, Crown Publishing Group, USA

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
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HUP0001-4	Introduction to Japanese Language and Culture	I/II	2	1	50
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Course objective

The course aims to develop basic communication skills in Japanese Language and help develop a basic understanding of Japanese culture in cross-cultural communication.

Course outcome

CO1: Gain a brief understanding about Japan as a country and Japanese culture.

CO2: Develop ability to use vocabulary required for basic level communication in Japanese language.

CO3: Able to write and read the first script in Japanese language.

CO4: Able to frame simple sentences in Japanese in order to handle everyday conversations

CO5: Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical-1: Orientation about Japan, its language, and its culture

Practical-2: Communication Skills 1: Vocabulary for basic Japanese language

Practical -3: Practice sessions

Practical-4: Writing Skills 1: Reading and writing first script in Japanese

Practical-5: Practice sessions

Practical- 6: Communication Skills 2: framing sentences

Practical- 7: Practice sessions

Practical- 8: Writing Skills 2: Write basic Japanese and practice

Recommended reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)

2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-5	Art of Theatre	I	2	1	50

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Course objectives:

The course aims to develop in the students, an actor's craft through physical and mental training.

Course Outcomes:

On completion of the course, students will be able to achieve the following:

- CO1: Understand and synthesize the working of the prominent genres of theatre across the world.
- CO2: Apply the skill of voice and speech in theatre and public speaking
- CO3: Apply the art of acting and also develop generic skills such as confidence, communication skills, self-responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.
- CO4: Apply skills acquired related to technical/ production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus:

Syllabus

- Practical 1: **Orientation in theatre**
- Practical 2: **Voice and Speech training**
- Practical 3: **Voice and Speech training:** practice sessions
- Practical 4: **Art of acting**
- Practical 5: **Art of acting:** practice sessions
- Practical 6: **Art of script writing**
- Practical 7: **Art of script writing:** practice sessions
- Practical 8: **Final performances**

Reference books:

1. Boleslavsky, R. (2022). *Acting: The First Six Lessons* (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). *No Drama Just Theatre* (1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., & Zigler, S. (1986). *A Practical Handbook for the Actor* (1st ed.). Vinatge Books New York.

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)

HUP0001-6	Introduction to French Language	I	2	1	50
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Course objective:

To help build a foundation and interest in French language so that the students can pursue the proficiency levels of the language in higher semesters.

Course outcomes:

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate basic knowledge about France, the culture and similarities/ differences between India and France

CO2. Learn to use simple language structures in everyday communication.

CO3. Develop ability to write in basic French about themselves and others.

CO4. Develop ability to understand beginner level texts in French

Syllabus

List of Practicals

Practical-1: Orientation about France, the language, and culture

Practical-2: Communication Skills 1: Vocabulary building for everyday conversations

Practical -3: Practice sessions

Practical-4: Reading and writing Skills : Reading and writing simple text in French

Practical-5: Practice sessions

Practical-6: Communication Skills 2: listening comprehension

Practical-7: Practice sessions

Practical-8: Writing Skills: Write basic French and practice

Recommended reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de Civilisation Françaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-7	Introduction to Spanish Language	I	2	1	50

Course objective:

To help build a foundation and interest in Spanish language so that the students can pursue the proficiency levels of the language in higher semesters.

Course outcomes:

On successful completion of the course the students will be able to achieve the following:

CO1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France

CO2. Learn to use simple language structures in everyday communication.

CO3. Develop ability to write in basic Spanish about themselves and others.

CO4. Develop ability to read and understand beginner level texts in Spanish

Syllabus

List of Practicals

Practical-1: Orientation about Spain, the language, and culture

Practical-2: Communication Skills 1: Vocabulary building for everyday conversations

Practical -3: Practice sessions

Practical-4: Reading and writing Skills : Reading and writing simple text in Spanish

Practical-5: Practice sessions

Practical-6: Communication Skills 2: listening comprehension

Practical-7: Practice sessions

Practical-8: Writing Skills: Write basic Spanish and practice

Recommended reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas ,Eva Garcia, Agustin Garmendia.
3. Chicos Chicas Libro del Alumno by María Ángeles Palomino

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-8	Art of Painting	I	2	1	50

Course objective

Painting is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in painting to lay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of painting.

CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.

CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of painting.

Syllabus

Practical 1: **Orientation in Painting tools & basics of lines, shapes, light, shadows and textures**

Practical 2: **The art of observation** how to see shapes in drawing

Practical 3: **Introduction Water color** how to handle water paints

Practical 4: **Introduction to acrylic colors** how to handle acrylic paints

Practical 5: **Explore layering paint and capturing the quality of light with paint.**

Practical 6: **Create landscape painting**

Practical 7: **Create Abstract painting**

Practical 8: **Paint on Canvas** (try to recreate any famous painting)

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine

Course Code	Course Name	Sem	Hours/ week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-9	Art of Drawing	I	2	1	50

Course objective

Drawing is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in drawing to lay a foundation for them as a hobby and/or a profession.

Course outcome:

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of drawing.

CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.

CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical 1: Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures

Practical 2: The art of observation how to see shapes in drawing

Practical 3: One/two-point basic linear perspective

Practical 4: Nature drawing and landscapes

Practical 5: Gestalt principles of visual composition

Practical 6: Figure drawing: structure and proportions of human body

Practical 7: Gesture drawing: expression and compositions of human figures

Practical 8: Memory drawing: an exercise to combine the techniques learnt

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-10	Nature Camp	I	2	1	50

Course Objective:

To create an opportunity for the students to develop affinity with nature and thus subsequently impact their ability to contribute towards sustainability of nature.

Course outcome:

After the completion of the course the students will be able to do the following:

CO1: Develop an affinity with nature by observing and understanding its marvels with guidance from experts

CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

Course content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Central Indian region or Forest fringe villages or work with an NGO from Central Indian region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, other wildlife etc)
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs
4. Man-animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department
5. Traditional practices in environment conservation – role of local communities and local NGOs

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	CHT2006				
Category	Basic Science Course				
Course Title	Chemistry of Smart Materials				
Scheme & Credits	L	T	P	Credits	Semester II
	2	0	0	2	

Course Outcomes

On successful completion of course student will learn:

1. Classify and explain the different types of sensors for various applications.
2. Discuss unique properties of nano-materials to solve challenges in our life and applications in computational world.
3. Discuss how spectroscopic methods are used for qualitative and quantitative analysis.
4. Analyze the utilization of green computing technology for environmental issues

UNIT-I: Smart Sensors and Materials

RFID and IONT materials: Synthesis, properties and applications in logistic information, intelligent packaging systems (Graphene oxide, carbon nanotubes (CNTs) and polyaniline).
Sensors: Introduction, types of sensors (Piezoelectric and electrochemical), nanomaterials for sensing applications (Strain sensors, gas sensor, biomolecules and volatile organic compounds).

UNIT-II: Nanomaterials

Introduction, classification, size dependent properties, surface area, optical and catalytic properties, Synthesis methods of nanomaterials- Top down and bottom-up approach.
Carbon nanomaterials: Types, properties and applications of CNT and graphene.
Applications of nano materials.

UNIT-III: Characterization techniques and computational tools:

Fundamentals of spectroscopy, Electronic Spectroscopy, Nuclear Magnetic Resonance Spectroscopy. Basics of Nuclear magnetic resonance quantum computer
Synthesis of drugs, basic soft-wares for bio-chemical assessment of drugs.

UNIT-IV: Green Computing and Chemistry

E-wastes- Types, environmental and health risks, segregation and
PROGRAM SCHEME & SYLLABUS B. TECH. (INFORMATION TECHNOLOGY) 2023-24 (NEP)

recycling(Hydrometallurgical, pyrometallurgical and direct recycling), Extraction of precious metals from e-wastes, Twelve principles of Green Chemistry. Green Computing, Role of Green Computing in Environment and Research, Green devices and Green data Servers.

Text Books:

1. Shikha Agrawal , Engineering Chemistry : Fundamentals and Applications, Cambridge University Press.
2. Dr. Rajshree Khare, A Textbook of Engineering Chemistry(AICTE), S.K. Kataria & Sons.
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.
4. A. K. Das and M. Das, An introduction to nanomaterials and nanoscience, CBS Publishers and Distributors
5. M Afshar Alam, Sapna Jain, Hena Parveen, Green Computing Approach Towards Sustainable Development, Wiley Interscience Publications.
6. Sensor & transducers, D. Patranabis, 2nd edition, PHI

Reference Books:

1. E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
2. Hans-Eckhardt Schaefer, Nanoscience: The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine, Springer-Verlag Berlin Heidelberg.

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	CHP 2006				
Category	Basic Science Course				
Course Title	Chemistry of Smart Materials Lab				
Scheme & Credits	L	T	P	Credits	Semester II
	0	0	2	1	

The Chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Apply the fundamental principles of measurement and skills in preparation and handling of hazardous chemicals and interpret the statistical data related to measurements.
2. Estimate the rate constants of reactions and order of the reaction and/or to validate adsorption isotherms.
3. Use of various computational tools for analysis of different spectral properties and bio-activities.

List of Experiments:

1. Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.
2. Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.
3. Basic statistical analysis of results of neutralization of acid against the base and preparing acceptable graphs using software.
4. Prediction of infrared/NMR spectral and analytical data of organic molecules using Computational Software.
5. Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert- Beer's Law.
6. To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find out order of the reaction and analysis of experimental data using Computational Software.
7. Molecular docking of drugs using open computational software.
8. Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software
9. Use of open access software for the interpretation of various parameters of materials including drugs

10. Estimation of Copper from PCB

Suggested Books/Reference Books:

1. S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.
2. J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.
3. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.
4. V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.
5. Ashutosh Kar , Advanced Practical Medicinal Chemistry, New Age International Publisher.

Suggested Reference Books:

1. David Young, Computational Chemistry: A Practical Guide for Applying Techniques to RealWorld Problems, Wiley Inter science Publications

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	MAT 2002				
Category	Basic Science Course				
Course Title	Discrete Mathematics				
Scheme & Credits	L	T	P	Credits	Semester II
	3	0	0	3	

Course Objective:

The objective of this course is to expose student to understand the basic importance of Logic, Number theory, Algebraic structures like groups and Field, combinatorics and graph theory I in computer science and Information technology.

Course Outcomes

On successful completion of the course, student shall be able to

1. Formulate problems and solve recurrence relations
2. Apply techniques of number theory to solve problems from linear congruences, coding theory etc. in cryptography.
3. Internalize logical notations to define and reason about fundamental mathematical concepts and use it derive logical inference.
4. Apply groups and fields in coding theory.
5. Understand the Lattice as algebraic structure and use it for pattern recognition and in cryptography.

Syllabus

Module 1: (9 Lectures)

Combinatorics: Addition and multiplication rule in combinatorics, Linear and Circular permutation, Combination, Binomial Identities, Inclusion and Exclusion Principle, distribution Principle, recurrence relations, generating function, examples using ordinary power series and exponential generating functions.

Module 2: (8 Lectures)

Modular Arithmetic: Modular Arithmetic, Euclid's Algorithm, primes, Fermat's theorem, Euler's theorem, Diophantine equations, Linear congruences, Chinese Remainder theorem, application to Cryptography.

Module 3: (7 Lectures)

Mathematical Logic: Statement and notations, connectives, Negation, conjunction, disjunction, conditional & bi-conditional statement. Tautologies, equivalence of formulas, Duality law, Tautological implications, Theory of inference for statement calculus.

Module 4: (9 Lectures)

Groups and Fields: Group definitions and examples, cyclic group, permutation groups, subgroups and homomorphism, co-sets, Lagrange's theorem and Normal subgroup, Error correcting codes, Hamming codes. Finite field, Galois field.

Module 5: (7 Lectures)

Lattice theory: Lattices as partially ordered set, Properties of Lattice, Lattices as algebraic system, sub lattices, direct product, homomorphism, some special Lattices.

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science: J. P. Tremblay and R. Manohar , Tata McGraw-hill.
2. Discrete Mathematics: Babu Ram, Pearson Publication.
3. Combinatorial Mathematics: C. L. Liu & D. P. Mohapatra, 3rd edition, Tata McGraw-hill.
4. David M Burton, 'Elementary Number Theory' , McGraw Hill, Seventh edition 2014.

Reference Books:

- Foundations of Discrete Mathematics: K. D. Joshi, New age international Publication.
- Discrete Mathematics: Kolman, Busby & Ross, Pearson Publication.

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	ITT2001				
Category	Engineering Science Course				
Course Title	Object Oriented Programming				
Scheme& Credits	L	T	P	Credits	Semester II
	3	0	0	3	

Course outcomes

Upon completion of the course, students will be able to

1. Differentiate between Procedural language and Object-Oriented language
2. Use basic features of object-oriented language to solve real life problems
3. Apply advanced features of object-oriented language to solve real life problems
4. Apply exception handling mechanism
5. Implement various file operations through different stream classes.
6. Demonstrate the significance of Multithreaded Programming, Networking, Applet, and Servlet in real-life applications.

Unit I

Introduction to Object Oriented Programming: Features of object-oriented programming languages like data encapsulation, inheritance, polymorphism, and late binding

Unit II

Basic Concept of OOP: Concept of a class, Access control of members of a class, instantiating a class, static and non-static members, overloading a method, Constructors, Garbage Collection, finalize () Method.

Unit III

Building the classes: Deriving a class from another class, access control of members under derivation, different ways of class derivation, overriding of a method, run time polymorphism, Use of super keyword and final keyword in inheritance, run time polymorphism. Abstract classes and methods, interface, implementation of interface, creating packages, importing packages

Unit IV

Exceptions, types of exception, use of try-catch block, handling multiple exceptions, using finally, throw and throws clause, user-defined exceptions, Generics, the generic

class with two type parameter, bounded generics, Collection classes: Arrays, Vectors, Array list, Linked list, Hash set, Queues, Trees.

Unit V

Introduction to streams, byte streams, character streams, linked lists, stacks, queues, trees, graphs, hash table, Set, Tree Set, File handling in Java, Serialization.

Unit VI

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, Inter-thread communications. Networking, Applet and Servlet.

Text Books

The Complete Reference: Java 2: Herbert Schildt

1. A programmer's Guide to Java SCJP Certification: A Comprehensive Primer: *Khalid A. Mughal and Rolf W. Rasmussen*, Third Edition.
2. Java Fundamentals: A Comprehensive Introduction: *Herbert Schildt and Dale Skrien*; Tata McGraw- Hill Education Private Ltd., 2013.
3. ArnoldKen, GoslingJ, "TheJavaProgrammingLanguage"5edition, MGH, AddisonWesley
4. MattWeisfeld, "The Object-Oriented Thought Process", Pearson

Reference Books

1. CoxBrad, "Object-Oriented Programming: An Evolutionary Approach", Addison-Wesley
2. Design Patterns by Erich Gamma, Pearson Education
3. Core JAVA Volume-II Advanced Features: *Cay S. Horstmann and Gary Cornell*; Eighth Edition; Prentice Hall, Sun Microsystems Press, 2008.
4. Java Programming: A Practical Approach: *C Xavier*; Tata McGraw- Hill Education Private Ltd., 2011

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	ITP2001				
Category	Engineering Science Course				
Course Title	Object Oriented Programming Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Course Outcomes

Upon completion of the course, students will be able to

1. Write simple programs in java language for the given problem statement.
2. Write advanced programs in java language to solve real life problems.
3. Design optimized and reusable codes for applications.
4. Implement data structures using object-oriented concepts.
5. Implement Multithreading and Networking mechanisms to solve real life problems.

Practical No.	Description
1	Program based on concepts of Class and Object
2	
3	Programs based on Constructor and Inheritance
4	
5	Programs based on Exception Handling and Collections
6	
7	Programs based on Package and Stream
8	
9	Programs based on Thread and Socket Programming
10	

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	ITT2002				
Category	Program Core Course				
Course Title	Data Structures				
Scheme & Credits	L	T	P	Credits	Semester II
	2	1	0	3	

Course Outcomes

Upon completion of the course, students will be able to

1. Analyze algorithms based on their complexities
2. Implement real world problems using Arrays
3. Implement real world problems using Link List
4. Analyze various searching and sorting algorithms
5. Use Trees as a data structure
6. Apply the graph structure for traversals and shortest path problems

Unit I

Introduction to Algorithms: Algorithm and its features. Analysis of Algorithms, Asymptotic notations, Recursion, Introduction to different programming paradigms

Unit II

Arrays: Memory Representation, Introduction to Stacks and queues and its implementation using arrays, De-queue and Priority queue. Concept and representation of Sparse matrices and basic operations on them.

Unit III

Linked List: Single and Doubly linked list and basic operations on them. Implementation of stacks and queues using linked lists. Classical Applications of linked list

Unit IV

Sorting Methods: Internal and External sorting, Bubble sort, Exchange sort, Insertion sort, Selection sort, Quick sort, Heap sort, Merge sort and Radix sort.

Searching Methods: Sequential, Binary, Indexed search, Hashing techniques and Collision-handling mechanisms

Unit V

Trees: Purpose, types, definition and terminologies, Memory representation of a binary tree. Tree traversal techniques, Binary search tree, Heap tree and Threaded binary trees. Multi-way trees: B-

Trees and B+ Trees.

Unit VI

Graphs and their applications: Purpose, types, definition and terminologies. Implementation in memory. Traversal using Depth-first and Breadth-first search techniques, Minimum Cost Spanning Trees: Concept and implementation using Prim's and Kruskal's algorithms and computation of Shortest Path using Dijkstra's algorithm.

Text Books

1. Fundamentals of Data Structures in C: E. Horowitz, S. Sahani and Anderson- Freed, University Press
2. Data Structures and Program Design in C: Robert Kruse, G. L. Tondo and B. Leung, PHI-EEE

Reference Books

1. Data Structures Using C / C++: Tanenbaum, Pearson.
2. An Introduction to Data Structures with Applications: J. P. Tremblay & P. G. Sorenson, McGraw Hill.

Text Books

1. Fundamentals of Data Structures in C: E. Horowitz, S. Sahani and Anderson- Freed, University Press, 2nd Edition.
2. Data Structures and Program Design in C: Robert Kruse, G. L. Tondo and B. Leung, PHI
3. An Introduction to Data Structures with Applications: J. P. Tremblay & P. G. Sorenson, 2 Edition, MGH.

Reference Books

1. Data Structures: P. S. Deshpande, O. G. Kakde 1st Edition, Wiley Dream Tech.
2. Data Structures Using C / C++: Tanenbaum, 3rd Edition, Pearson.

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	ITP2002				
Category	Program Core Course				
Course Title	Data Structures Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Course outcomes

Upon completion of the course, students will be able to

1. Analyze the time and space complexities of a given algorithm
2. Use linear data structures for solving real world problems
3. Implement various sorting and searching algorithms
4. Use non-linear data structures for solving real world problems

Practical No.	Description
1	Program based on arrays
2	
3	Application of Stacks and Queue
4	
5	Programs based on Link List
6	
7	Programs based on Graphs
8	
9	Programs based on Trees
10	

Syllabus for B. Tech. Semester II
Department of Information Technology

Course Code	ITT 2003				
Category	Vocational and Skill Enhancement Course (VSEC)				
Course Title	Creativity, Innovation & Design Thinking				
Scheme& Credits	L	T	P	Credits	Semester II
	2	0	0	2	

Course Outcomes:

At the end of this course, students will:

1. Practice the processes and methods of creative problem solving: observation, definition, representation, ideation, evaluation and decision making
2. Develop their creative and innovative thinking skills
3. Create building blocks of innovation
4. Practice and value teaming, communication, and creative problem solving
5. Design using human centered approach

Unit I

Introduction: Meaning and concept of creativity - Creativity Process- Nature and characteristics of creativity, Factors affecting creativity, Recognizing and avoiding mental blocks, understanding creativity from studying the profiles of most creative personalities.

Unit II

Pattern Breaking: Thinking preferences. Lateral Thinking, Different techniques of creative problem solving- Brain storming, SCAMPER, Mind Mapping & Simulation, Metaphoric thinking, Outrageous thinking, other (new approaches)

Unit III

Decision and Evaluation: Focused Thinking Framework, Six Thinking Hats, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

Unit IV

Innovation: Meaning and Importance — Difference with Creativity, Invention and Discovery Process, Building Blocks for Innovation, Nine lessons for Innovation,

Unit V

Design Thinking: Understanding the design thinking approach, Human centered design, Case Studies on Innovation business ideas like Amazon, Swiggy, Red bus, Flipkart, Ola, Big Basket,

methods and techniques — organizational Aspects — Economic Aspects like venture capital, angel investors — Evaluation of Effectiveness of Innovation

Unit VI

Ethical Considerations: Introduction to intellectual property rights - Patents, Copyrights©, Trademarks®, Trade Secret, Unfair Competition.

Reference Books:

1. The Seven Habits of Highly Effective People, by Stephen R. Covey
2. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
3. The art of Innovation, by Tom Kelley and the Deep Dive story

Text Book:

1. Design Thinking by Hasso Plattner, Christoph Meinel, Larry Leifer

Course Assignments for continuous assessment of 50 Marks (NO written exam)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie/game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples Large teams videos

Syllabus for B.Tech. Semester II
Department of Information Technology

Course Code	HUT1001/2001				
Category	Vocational and Skill Enhancement Course (VSEC)				
Course Title	Foundational Literature of Indian Civilization				
Scheme & Credits	L	T	P	Credits	Semester II
	2	0	0	2	

Course outcome:

At the end of the course the students will be able to achieve the following

1. Understand the Indian knowledge system and its scientific approach
2. Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus
3. Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools
4. Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

Syllabus

1. Unit 1: Overview of Indian Knowledge System: Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.
2. Unit 2: The Vedic corpus: Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.
3. Unit 3: Indian Philosophical systems: Development and unique features, Vedic schools of philosophy, *Samkhya* and *Yoga* School of philosophy, *Nayay* and *Vaisesika* school of philosophy, *Purva-mimamsa* and *Vedanta* schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches
4. Unit 4: Indian wisdom through ages: *Panchtantras*, *Purans*: contents and issues of interests, *Itihasa*: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: *Kalidas*, *Vishakadutta*, *Bhaobhuti*, *Shudraka**

*any one text as decided by the course teacher

Reference material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022
2. S.C. Chatterjee and D.M. Datta, *An introduction to Indian Philosophy*, University of Calcutta, 1984

Syllabus for B.Tech. Semester II
Department of Information Technology

COURSE: SPORTS-YOGA-RECREATION			
L: 1 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week		Total Credit: 02	
	Course Code	Credit	No. of Lecture/Practical
Theory	PET 2001	1	1 Hour per week
Practical	PEP 2001	1	2 Hours per week

Aim of the Course: The course aims at creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness to promote Health and wellness through Healthy Lifestyle.

Objectives of the Course:

1. To impart the students with basic concepts of Sports, Yoga and Recreational activities for health and wellness.
2. To familiarize the students with health-related Exercise and evaluate their Health-related Fitness.
3. To make Overall growth & development with team spirit, social values and leadership qualities among students through various sports, games and Yogic activities.
4. To create Environment for better interaction and recreation among students as neutralizer for stress through various minor and recreational games.

Course Outcomes: On completion of the course, students will be able to:

5. Understand fundamental skills, basic principle and practices of sports and Yoga.
6. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
7. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
8. practice Healthy & active living with reducing Sedentary Life style.

Course Content: Unit1:- Theory: Introduction

- Meaning, Definition and Importance of Health & Wellness
- Dimensions of Health and Wellness
- Factors influencing Health and Wellness
- Physical Fitness, Nutrition, Habits, Age, Gender, Lifestyle, Body Types
- Health & Wellness through Physical Activities, Sports, Games, Yoga and Recreation activities
- Causes of Stress & Stress relief through Exercise and Yoga
- Safety in Sports

Unit 2: - Practical- Exercises for Health and Wellness

- Warm-Up and Cool Down - General & Specific Exercises
- Physical Fitness Activities
- Stretching Exercises
- General & Specific Exercises for Strength, Speed, Agility, Flexibility, coordinative abilities
- Cardiovascular Exercises
- Assessment of BMI
- Relaxation techniques
- Physical Efficiency Tests

Unit 3: - Yoga

- Shukshma Vyayam
- Suryanamaskar
- Basic Set of Yogasanas – Sitting, standing, supine and prone position
- Basic Set of Pranayama & Meditation

References:

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

**Syllabus for B.Tech. Semester
Department of Information Technology**

Exit Courses			
1	Introduction to Computer Hardware and Networking	Offline Certification Course	8

Course Outcomes

Upon completion of the course, students will be able to

1. Diagnose and perform computer maintenance
2. Configure computer networks
3. Configure desktop and server systems
4. Diagnose and trouble shoot network faults
5. Configure security policies

Course Content:

- Introduction to Operating Systems and Diagnostic Utilities
- Basic Networking: Introduction to Computer Networks, Elements of Networks, Types, Topologies, communication channels, Connectors, Jacks, Patch Panels, NIC, Network Devices, Address Resolution Protocols, Registration of a domain.
- Installation and Management of Windows and Linux Operating Systems
- Introduction to wireless technologies
- Network configuration and Trouble shooting
- Configuration of local security policies and security tools

Syllabus for B. Tech. III Semester
Department of Information Technology

Course Code	ITT3001				
Category	Program Core Course (PCC)				
Course Title	Computer Organization and Architecture				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes

On successful completion of the course, the student will be able to:

1. Understand different hardware units of a computer system and the instruction set
2. Design the various components of arithmetic unit
3. Design a memory system and analyze its performance
4. Design control unit
5. Differentiate between various I/O handling techniques
6. Apply design techniques to enhance performance using pipelining

Unit I: Data Representation and Arithmetic

Number representation, Addition of positive numbers, Logic design of fast adders, Addition & subtraction, Arithmetic & branching conditions, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer division, Floating point numbers & operations, IEEE standard

Unit II: Basic Structure of Computer Hardware & Software

CPU, Memory, Input-Output Subsystems, Control unit. Instruction set architecture of a CPU, Registers, Instruction execution cycle, addressing modes, instruction set

Unit III: Memory System Design

Semiconductor RAM memories, Memory system considerations, Semiconductor ROM memories, Multiple-module memories and interleaving, Cache memories, mapping functions, replacement algorithms

Unit IV: Processing Unit

Fundamental concepts, bus architecture, execution of complete instruction, hardwired control, micro programmed control, microinstruction format, microinstruction sequencing

Unit V: I/O Interfacing

Input-output organization, I/O mapped I/O and memory mapped I/O, Direct Memory Access, interrupts and interrupts handling mechanisms, device identification, vectored interrupts, interrupt nesting, I/O interfaces, synchronous vs. asynchronous data transfer, I/O channels, USB

Unit VI: Pipelining

Basic concepts, delayed branch, branch prediction, data dependency, multiple execution units, performance considerations, basic concepts in parallel processing and classification of parallel architectures

Text Books

1. Computer Organization: Carl Hamacher, Z Vranesic, S Zaky, McGraw Hill
2. Computer Organization and Design: D. A. Patterson and J. L. Hennessy, Morgan Kaufmann

Reference Books

1. Computer Architecture and Organization: J. P. Hayes, McGraw Hill, Third Edition.

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	ITT3002				
Category	Program Core Course (PCC)				
Course Title	Design and Analysis of Algorithms				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	III

Course Outcomes

On successful completion of the course, the student will be able to:

1. Justify the fundamental needs of algorithms and the reason for their analysis
2. Analyze the time and space complexity of various algorithms
3. Exhibit knowledge of standard algorithm design techniques
4. Apply different algorithm design techniques for problem-solving
5. Design efficient algorithms for various computing problems
6. Know the limitations on the time complexity of algorithms for problem-solving

Unit I

Mathematical foundations, Summation of arithmetic and geometric series, asymptotic notations for analysis of algorithms, Recurrence relations, Amortized analysis and application. Review of Basic Tree and Graph Traversals and Search Techniques

Unit II

Divide and Conquer: Basic strategy. Case studies of Binary Search, Quick sort, Merge sort and Matrix operations. Other applications.

Greedy Method: Basic strategy, Case studies of Job Sequencing problem, Minimum Cost Spanning Trees and Single Source Shortest path

Unit III

Dynamic Programming: Basic strategy. Concept of Multistage Graphs. Case studies of All Pairs Shortest Path Algorithm, Optimal Binary Search Trees, Traveling Salesman Problem, Longest Common Subsequence Problem and its variations. Other applications

Unit IV

Backtracking: Basic strategy. Case studies of n-Queen's problem, Graph Coloring Problem, Hamiltonian Cycles. Other applications

Unit V

Branch and Bound: basic strategy. Implementations of some of the above problems using Branch and Bound Technique. Other applications

Unit VI

Non-deterministic algorithms, NP-hard and NP-complete problems, Decision and Optimization problems, Graph based problems on NP Principle. Introduction to Approximation algorithms.

Text Books

1. Introduction to Algorithms: Thomas H. Cormen et.al, MIT Press , Fourth Edition
2. Fundamentals of Computer Algorithms: Horowitz, Sahani, Rajsekharam, Computer Science Press , Second Edition
3. Fundamentals of Algorithms: Brassard, Bratley, Prentice Hall, India

Reference Books

1. The Design and Analysis of Algorithms: Dexter C. Kozen, Springer.
2. Foundations of Algorithms: Dr. S. R. Sathe, Penram Publications.

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	ITP3002				
Category	Program Core Course				
Course Title	Design and Analysis of Algorithms Lab.				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	III

Minimum 10 practical assignments based on the course

Course outcomes:

On successful completion of the course, the student will be able to:

1. Analyze the functional requirements of algorithms for solving problems
2. Derive the Time Complexity of given Algorithms
3. Demonstrate knowledge of different programming paradigms
4. Apply the different programming paradigms to solve problems

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	ITP3003				
Category	Vocational and Skill Enhancements Course (VSEC)				
Course Title	IT Infrastructure Services Lab.				
Scheme & Credits	L	T	P	Credits	Semester
	0	1	2	2	III

Minimum 10 practical assignments based on the course

Course outcomes:

On successful completion of the course, the student will be able to:

1. Install different Linux distributions
 2. Create users and groups on the Linux server
 3. Apply process management commands
 4. Use package and storage management tools
 5. Write shell scripts
 6. Install and configure services on the Linux server
- Introducing Linux: History, Linux distribution, Linux basics: Linux vs Microsoft Windows
 - Linux Basic commands, Linux file system, File handling commands, file permissions
 - Users and Groups, Startup and Services
 - Package Management: Introduction to Package Management, Package Management commands.
 - Storage management: Storage basics, Fdisk command Logical volume management
 - Shell script and shell programming

 - Infrastructure services: Configuration of NTP, DNS, and Mail Servers.

 - Web services: Apache web Server, File sharing with Samba and NFS, Print servers

Text Books:

1. Linux Administration: A Beginner's Guide, Seventh Edition, by Wale Soyinka, McGraw Hill Publication.
2. Pro Linux System Administration: James Turnbull, Peter Lieverdink, and Dennis Matotek, Apress Publication

Reference Books:

1. Linux - The Complete Reference, Tata McGraw Hill Publication, Sixth Edition

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	MAT 3002				
Category	MDM				
Course Title	Probability and statistics				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Pre-requisite: Basics of Probability and Statistics.

Course Objective:

The objective of this course is to expose student to understand the basic importance fundamental principles of probability, including probability distributions, random variables, basic statistical methods used for data analysis, inferential statistics, hypothesis testing, confidence intervals, and regression analysis in computer science and Information technology.

Course Outcomes:

On successful completion of the course, student shall be able to

1. Grasp the meaning of discrete and continuous random variables, probability distribution. Interpret the meaning of probabilities derived from distributions. This involves understanding what the calculated probabilities represent in practical terms and drawing conclusions from the results.
2. To analyze and interpret stochastic models, including calculating probabilities, transition probabilities, and steady-state probabilities within stochastic systems.
3. Grasp the fundamental concepts of curve fitting like regression techniques, model selection, and the use of different types of curves or functions to approximate data.
4. Understand the fundamental concept of hypothesis testing, including the null hypothesis (H_0) and alternative hypothesis (H_1), significance levels, p-values, and the basic logic behind hypothesis testing.
5. To apply MLE to various statistical models, such as linear regression, exponential distribution, etc. They should understand how to formulate likelihood functions and derive estimators for unknown parameters.

Syllabus

Module 1 (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 2: (8 Lectures)

Joint probability function, Introduction to stochastic process, random walk, stationary and auto regressive process, transition probability Matrix, Discrete time Markov chain.

Module 3: (8 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression - Rank correlation, Multiple regression and correlation.

Module 4: (8 Lectures)

Sampling Distributions, Point and Interval Estimations, Testing of Hypothesis for single mean and proportion.

Module 5: (7 Lectures):

Testing of Hypothesis for difference of mean and proportion, Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes, maximum likelihood estimation

Text Books:

1. M R. Spiegel , Theory and Problems of probability and statistics ;2nded ;Schaum series
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Reference Books:

1. Maurtis Kaptein, Statistics for data science, An introduction to probability, statistics and Data Analysis, Springer 2022.
2. Jay L Devore, Probability and Statistics for Engineering and sciences, 8th edition, Cenage learning.

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	ITT2980-1				
Category	Open Elective Course				
Course Title	Open Elective-I: Web Development				
Scheme & Credits	L	T	P	Credits	Semester
	2	0	0	2	III

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Exhibit an understanding of the Internetworking concept and associated technologies
2. Create web pages using HTML.
3. Plan, design and published websites.
4. Write PHP scripts to handle HTML forms
5. Create PHP programs that use various PHP library functions, and that can work with files.

Unit I

Introduction, Network hardware, LAN, MAN, WAN, Network topologies: Bus, Star and Ring. Basic tools of Internet access: Email, FTP, WWW etc, Internet Protocol- HTTP, FTP, SNMP, Email protocols –SMTP, POP3, IMAP, MIME

HTML Programming: Tags, Special Characters, Heading, Paragraph, creation of List.

Unit II

Tables in HTML: Creation of tables, Including Images in Web Pages: Image Tag, Image mapping, Frames in HTML, creation of Forms, Introduction to Cascading style sheet (CSS).

Unit III

Introducing PHP and MySQL: History, Features, and Architecture. Learning PHP: Using variables, Statements, and Operators. Using conditional statements.

Unit IV

Understanding and using different loops- for, while, do while. Understanding and using Arrays: Using Arrays to Group Related Values.

Unit V

User defined function: Defining and Invoking Functions, Using arguments and return values, Defining global and local variables, and Importing function definitions.

String and regular expression: Determining length, Comparing strings Manipulating string case, Padding and stripping a string. Counting characters and words.

Unit VI

Using Files, Sessions, cookies: Reading and Writing Files, Managing sessions and Using sessionvariables, Storing data in Cookies

Text Books

Text Books

1. The Complete Reference HTML & XHTML : Thomas Powell, 3rd Edition, Tata McGraw Hill.
2. How to Do Everything with PHP and MySQL by Vikram Vaswani

Reference Books

1. PHP 5 / MySQL Programming for the Absolute Beginner: Andy Harris, 1st Edition Thomson Publication
2. Web Design: A Beginners Guide: Wendy Willard, 2nd Edition, MGH.

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	HUT3001				
Category	HSSM				
Course Title	Business Communication				
Scheme & Credits	L	T	P	Credits	Semester
	2	0	0	2	III

Course Objective

The course aims to develop the skills of students to proficiently craft compelling business documents and employ strategic verbal communication techniques. By honing these skills, students will gain the ability to convey ideas persuasively and interact confidently in diverse business contexts.

Course Outcomes:

On successful completion of the course the students will be able to achieve the following:

1. Understand the fundamentals of business communication.
2. Apply tools and techniques to create effective workplace correspondence.
3. Analyse and apply visual design principles to create business documents.
4. Understand and evaluate information to draft reports.
5. Apply and evaluate strategies for effective communication for employment.

Syllabus:

UNIT 1: Fundamentals of Business Communication (6 Hours)

Definition of communication, Emergence of communication as a key concept in the Corporate and Global world, Types- Internet, Blogs, E-mails, social media, Channels- Formal and Informal: Vertical, Horizontal, Diagonal, Grapevine, Persuasive Communication- Negotiation Skills, PAC concept

UNIT 2: Business Correspondence (6 Hours)

Planning, Writing, and Completing Business Messages

Personnel Correspondence: Job Application Letter, Letter of Acceptance of Job Offer, Letter of Resignation, Letter of Appointment, Promotion and Termination, Letter of Recommendation

Trade Correspondence: Inquiry, Order, Credit and Status Enquiry, Complaints, Claims, Adjustments, Consumer Grievance Letters

UNIT 3: Visual and Content Creation (6 Hours)

Visual design principles, Ethics of visual communication, selecting visuals for presenting data, Content Creation: Website, Help file, User Guides, Promotional leaflets and fliers

UNIT 4: Reports (4 Hours)

Basic formats and types of reports - Feasibility, Progress, Project, Case Study Evaluation, Agenda, Notices, Minutes of Meeting, Organizational announcements, Statement of Purpose.

UNIT 5: Communication for Employment (4 Hours)

Pre-interview technique- NOISE Analysis, Job Description and Resume, Creating LinkedIn Profile, Effective use of job portals, Business etiquette.

Text Books:

1. Sharon Gerson, Steven Gerson, “Technical Communication: Process and Product”, 2018, Pearson
2. Courtland L Bovee, John V Thill and Roshan Lal Raina “Business Communication Today”, 14th edition Pearson
3. P.D. Chaturvedi and Mukesh Chaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.

Reference Books:

1. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
2. Sanjay Kumar, Pushpa Lata, Communication Skills, 2nd Edition, Oxford Publication, 2018
3. William Strunk Jr. and E.B. White, The Elements of Style, Allyn & Bacon, A Pearson Education Company, 2000

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	HUT3002				
Category	HSSM				
Course Title	Environment Education				
Scheme & Credits	L	T	P	Credits	Semester
	2	0	0	2	III

Course Outcomes:

On successful completion, of course student will able to do the following:

1. Understand and appreciate the historical context of human interactions with the environment.
2. Understand the concept of natural resources and their sustainable development
3. Develop a critical understanding of the environmental issues of concern
4. Understand the concepts of ecosystems, biodiversity and conservation
5. Understand broad aspects of environmental management and assessment systems

Syllabus:

UNIT 1: Humans and the Environment (4 Hours)

Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change; emergence of environmentalism

UNIT 2: Natural Resources and Sustainable Development (4 Hours)

Definition of resource; Classification of natural resources Water resources; Soil and mineral resources; Energy resources; Sustainable Development Goals (SDGs)

UNIT 3: Environmental Issues: Local, Regional and Global (6 Hours)

Environmental issues and scales, Pollution, Land use and Land cover change, Global change, case studies/field visit

UNIT 4: Conservation of Biodiversity and Ecosystems (6 Hours)

Biodiversity and its distribution – India and the world; Ecosystems and ecosystem services, Threats to biodiversity and ecosystems; Major conservation policies and practises, case studies/field visit

UNIT 5: Environmental Management (6 Hours)

Introduction to environmental laws and regulation, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis; Environmental audit and impact assessment; Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme, case studies/field visit.

Text and Reference Books:

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press
4. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications <https://sdgs.un.org/goals>
5. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.

6. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
7. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
8. Singh, Kartar and Anil Shishodia (2007) 'Environmental Economics: Theory and Applications', Sage,
9. Karpagam. M (2019) Environmental Economics: A textbook, Sterling
10. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
11. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2ndEdition. CRC Press.
12. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
13. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
14. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
15. N. Mani (2020) Environmental Economics, New NC Century
16. Subhashini Muthukrishnan (2015) Economics of Environment, PHI
17. Rabindra N. Bhattacharya (2001) Environmental Economics: An Indian Perspective, Oxford University press

Syllabus for B. Tech. Semester III
Department of Information Technology

Course Code	ITP3005				
Category	Field Project (FP)				
Course Title	Field Project				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	4	2	III

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Understand problems existing in industry/society
2. Perform requirement analysis
3. Analyze data as per requirements
4. Document the analysis
5. Suggest a solution to the problem

Field projects bridge the gap between theory and practice by allowing students to work on real--world problems.

Students will be working in groups to identify of domain for survey/data collection. They will conduct the survey, analyze the data, and propose solutions to the problem. They will prepare a report on the study and analysis done by them.

Syllabus for B. Tech. III Semester
Department of Information Technology
HONOR COURSE

Course Code	ITTH3100-1				
Category	Honor Course				
Course Title	Blockchain and Web3 Programming				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply concepts of Blockchain in different use cases
2. Use Solidity for writing simple smart contracts
3. Deploy smart Contracts
4. Create Decentralized applications
5. Explore emerging trends in Web3 programming

Unit 1: Introduction to Web3 and Blockchain Basics

Overview of Web 3.0: Evolution from Web 2.0 to Web 3.0, Understanding the concept of Blockchain, Key differences between centralized and decentralized networks, Introduction to Ethereum: History and significance, Understanding Smart Contracts: Use cases and importance, Cryptography in Blockchain: Public-private key pairs, signing transactions

Unit 2: Ethereum Ecosystem and Solidity Programming

Deep dive into Ethereum: Ethereum accounts, Gas, Transactions and Blocks, Introduction to Solidity: Understanding its syntax and semantics, Smart Contract Development: Writing, compiling, and deploying Solidity smart contracts, Tools for Solidity development: Remix IDE, Truffle Suite

Unit 3: Web3 Development and Interaction with Smart Contracts

Setting up Web3.js: Introduction and setting up the environment, Web3.js APIs: Understanding the different functionalities and their usage, Interacting with Ethereum Blockchain using Web3.js: Creating, compiling, and deploying smart contracts, Event, and Error Handling in Web3.js

Unit 4: Building Decentralized Applications (DApps)

Introduction to DApps: Understanding their structure and design principles, Creating a DApp: Frontend development to interact with smart contracts, Connecting DApps with Ethereum Wallets: Usage of MetaMask and WalletConnect, DApp testing and debugging: Tools and techniques

Unit 5: Advanced Topics and Emerging Trends

Introduction to IPFS: Understanding decentralized storage, Decentralized Finance (DeFi): Overview and its impact on traditional finance, Exploring other blockchain platforms: Binance Smart Chain, Polkadot, etc., Security in Web3: Best practices and common pitfalls, Future Trends in Web3: Layer 2 solutions, Web3 in IoT and AI.

Reference Books:

1. Elrom, E. (2019). *The Blockchain developer: A practical guide for designing, implementing, publishing, testing, and securing distributed Blockchain-based projects.* Apress.
2. Solorio, K., Kanna, R., & Hoover, D. H. (2019). *Hands-on Smart Contract Development with Solidity and Ethereum: From Fundamentals to Deployment.* O'Reilly Media.

Syllabus for B. Tech. III Semester
Department of Information Technology
MINOR COURSE

Course Code	ITTM3100-1				
Category	Minor Course				
Course Title	Web Designing				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	III

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Exhibit the knowledge of Internetworking concept and associated technologies
2. Create web pages using HTML.
3. Plan, design and publish websites.
4. Write PHP scripts to handle HTML forms
5. Create PHP programs that use various PHP library functions, and that can work with files.

Unit I

Introduction, Network hardware, LAN, MAN, WAN, Network topologies: Bus, Star and Ring. Basic tools of Internet accesses: Email, FTP, WWW etc, Internet Protocol- HTTP, FTP, SNMP, Email protocols –SMTP, POP3, IMAP, MIME

HTML Programming: Tags, Special Characters, Heading, Paragraph, creation of List.

Unit II

Tables in HTML: Creation of tables, Including Images in Web Pages: Image Tag, Image mapping, Frames in HTML, creation of Forms, Introduction to Cascading style sheet (CSS).

Unit III

Introducing PHP and MySQL: History, Features, and Architecture. Learning PHP: Using variables, Statements, and Operators. Using conditional statements.

Unit IV

Understanding and using different loops- for, while, do while. Understanding and using Arrays: Using Arrays to Group Related Values.

Unit V

User-defined function: Defining and Invoking Functions, Using arguments and return values, Defining global and local variables, and Importing function definitions.

String and regular expression: Determining length, Comparing strings Manipulating string case, Padding and stripping a string. Counting characters and words.

Unit VI

Using Files, Sessions, and cookies: Reading and Writing Files, Managing sessions and Using sessionvariables, Storing data in Cookies.

Text Books

3. The Complete Reference HTML & XHTML : Thomas Powell, 3rd Edition, TMH.
4. PHP and MySQL : Vikram Vaswani, McGraw Hill

Reference Books

1. PHP 5 / MySQL Programming for the Absolute Beginner: Andy Harris, 1st Edition Thomson Publication
2. Web Design: A Beginners Guide: Wendy Willard, 2nd Edition, MGH.
3. www.php.net

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITT4001				
Category	Program Core Course				
Course Title	Formal Languages and Automata Theory				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Design Finite automata for real-life problems
2. Apply the concepts of grammar and formal languages
3. Analyze the problem and apply an appropriate computational model to solve it
4. Exhibit the knowledge of undecidable problems
5. Exhibit the knowledge of recursive function theory
6. Solve computational problems regarding their computability and complexity

Syllabus:

Unit I: Introduction: Strings, Alphabet, Language, Operations, Finite state machine, Definitions, Finite automation model (FA), Acceptance of strings and languages, Non-deterministic finite automation, Deterministic finite automation, Equivalence between NFA & DFA, Conversion of NFA into DFA, Minimization of FSM, Equivalence between two FSM's, Two Way finite automata, Myhill-Nerode Minimization theorem, Moore & Mealy machines

Unit II: Regular Expressions: Regular sets, Regular expressions (RE), Identity rules, Manipulation of regular expressions, Equivalence between RE and FA, Pumping lemma, Closure properties of regular sets, Regular grammars (RG), Right linear and Left linear grammars, Equivalence between regular linear grammar and FA, Interconversion between RE and RG

Unit III: Grammars: Context-free grammar, Derivation trees, Chomsky normal form, Greibach normal form, Push down Automata, Definition, Model, Acceptance of CFL, Equivalence of CFL & PDA, Interconversion, Enumeration of properties of CFL

Unit IV: Push down automata (PDA): Non-determinism, acceptance by two methods and their equivalence between PDA and CFG, closure and decision properties of CFLs

Unit V: Turing machine: variants, recursively enumerable set; recursive sets TM as a computer function, decidability and solvability, Halting Problem, Post correspondence Problems (PCP) and unsolvability of ambiguity problem of CFGs, Church's hypothesis

Unit VI: Computable Functions: Partial, total, constant functions, Primitive Recursive Functions, Bounded Minimization, Regular function, Recursive Functions, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and NP-hard Problems

Text Books

1. Theory of Computer Science: K. L. P. Mishra and N. Chandrasekaran, PHI, 3rd Edition.
2. An Introduction to Formal Languages and Automata: Peter Linz, 3rd Edition, Narosa Publication
3. Theory of Computation: Michael Sipser, India Edition, Cengage Learning

Reference Books

1. Introduction to Languages and the Theory of Automata: John C. Martin, 3rd Edition, MGH
2. Introduction to Automata Theory, Languages and Computation: J. E. Hopcroft, Rajeev Motwani, 2nd Edition, Pearson Education

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITT4002				
Category	Program Core Course (PCC)				
Course Title	Database Management System				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	IV

Minimum 10 practical assignments based on the course:

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Exhibit knowledge of Data models and DBMS architectures
2. Design optimal database
3. Apply query processing
4. Demonstrate knowledge of various concurrency and recovery techniques
5. Exhibit the knowledge of Advanced Databases
6. Implement database system for various applications

Unit I : Introduction to database systems: Overview, File systems Vs DBMS, Various data models, Levels of abstraction, Structures of DBMS, Relational model, Relations and Integrity constraints, Relational algebra, SQL

Unit II: Database design: Overview of database design, ER model, Features of ER model, Conceptual design using ER model, Scheme refinement and normal forms, Scheme refinement, Use of decompositions, Functional dependencies, Multi-valued dependencies

Unit III: Query optimization and evaluation: Introduction to query processing, Selection operation, Projection operation, Join operation, Set operation and Aggregate operation, Relational query optimization, Translating SQL queries, estimating the cost, Relational algebra equivalence

Unit IV: Concurrency control and recovery: Concepts of transaction, Transactions and schedules, Lock based concurrency control, Lock management, specialized locking techniques, Concurrency control without locking, Crash recovery, Introduction to crash recovery, Log recovery, Check pointing.

Unit V: NoSQL Databases: Introduction, Differences from Relational Databases, Basic Schema and data types, Types of NoSQL Databases. Use of NoSQL in Industry. An Overview of Big Data

Unit VI: Data Storage for Modern High-Performance Business Applications: Implementing a Document Database, Column Family Database, and Graph Database

Text Books

1. Database Systems Concepts: Silberschatz, Korth, Sudarshan, McGraw-Hill , Seventh Edititon
2. Database Management Systems by RamaKrishna & Gehrke, 3rd Edition, 2018, McGraw-Hill

Education Reference Books

1. Fundamentals of Database Systems: R. Elmasri, S.B. Navathe, Pearson Education, 6th Edition
2. Seven Databases in seven weeks: a guide to modern databases and the NoSQL movement.
Perkins, L., Redmond, E., & Wilson, J. (2018). Pragmatic Bookshelf
3. Big Data and Analytics', Wiley India, Seema Acharya, Subhashini Chellappan Second Edition

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITP4002				
Category	Program Core Course (PCC)				
Course Title	Database Management System Lab.				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply DDL, DML, and DCL commands
2. Write queries using SQL
3. Apply various functions and clauses in SQL
4. Use PL/SQL for database operations
5. Creating a database using NOSQL

Description
Implement Data Definition Language
Implement Data Manipulation language
Implement arithmetic, comparison, and logical operators in a database
Implement SQL character Numeric and date functions in a Database
Implement order by, group by, and having clauses in a database
Implement sub-queries in a database
Study and implement of PL/SQL data type
Implement control and loop control statements in PL/SQL
Implement cursor, and trigger. & exceptions in PL/SQL
Implement procedures & functions in PL/SQ
Implement PostgreSQL SQL commands
Implement PostgreSQL SQL datatypes
Use Cases Real World NoSQL Database Examples for Developers

Syllabus for B. Tech. Semester IV
Department of Information Technology

Course Code	ITT4003				
Category	Program Core Course				
Course Title	Software Engineering				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply different Software Development Process Models for solving real-world problems
2. Analyse various Project Estimation techniques and Risk Strategies for software project development
3. Apply UML Modelling to design diagrams for the project
4. Analyze Quality Assurance parameters and respective methodologies
5. Apply the knowledge of Software Design Fundamentals for software building
6. Analyze the impact of different Software Testing Strategies

Unit I

Introduction to Software Engineering, Software Myths, Software Engineering-A Layered Technology, Software Process Framework, Software Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Process Model, Agile Process Model: Extreme Programming (XP), Adaptive Software Development (ASD), Scrum, Dynamic System Development Method (DSDM), Case Studies

Unit II

Requirement Analysis, Software Requirements Specification: Functional, Non-Functional Requirements, User requirement, System requirements. Software Project Management- Process Metrics, Software Measurement, Project Evaluation and Estimation Techniques: Decomposition Techniques, LOC -based Estimation, Function Point based Estimation, Cost Estimation, Project Scheduling. Risk Management -Risk Strategies, Software Risks, Risk Identification, Risk Refinement, Risk Mitigation, Monitoring and Management, RMMM plan

Unit III

Unified Modelling Language diagrams for designing using StarUML: Use Case Diagram, Activity diagram, Data Flow Diagram, Entity Relationship (ER) Diagram, Class Diagram and their usage, Case studies

Unit IV

Quality Management - Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Statistical Software Quality Assurance, Software Reliability, Change Management - Software Configuration Management, SCM Repository, SCM Process

Unit V

Software Design Fundamentals- Design Concepts, Effective Modular Design, User Interface Design, Dashboard designing, guidelines and standards, Case Studies

Unit VI

Software Testing Techniques- Testing Life Cycle, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging. Software Testing fundamentals, Black Box Testing, White Box Testing, Automated Testing using Selenium, Software Re-engineering, Reverse Engineering, Restructuring

Text Books

1. Software Engineering: Kassem A. Saleh, India Edition, Cengage Learning 1st Edition
2. Software Engineering, Principles and Practices: Rajesh Narang, MG
3. Ian Sommerville; Software Engineering; Seventh Edition; Pearson Education. 2008

Reference Books

1. Software Engineering: Kassem A. Saleh, India Edition, Cengage Learning
2. Software Engineering: Schach, Special Indian Edition, TMH.
3. David Gustafsan, Software Engineering; Schaum's Series, Tata McGraw Hill
4. Rajib Mall, Software Project Management, 5th Edition, McGrawHill

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITP4003				
Category	Program Core Course				
Course Title	Software Engineering Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

6. Apply different Software Development Process Models for solving real-world problems.
7. Apply different Project Estimation techniques for software project development.
8. Design UML diagrams using the tool.
9. Apply different Software Testing Strategies.

Description
To study and compare various software development process models.
To state and analyze the problem definition for the mini-Project
Design SRS (Software Requirement Specification) document for Mini Project.
To study Project Estimation Techniques
Design all UML diagrams using the STARUML tool
To study different Software Testing Tools
Design Test Cases for Mini Projects and perform testing

Tool used : StarUML

Group Activity : Mini Project Designing

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITP4005				
Category	Vocational and Skill Enhancements Course (VSEC)				
Course Title	Software Tools				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	4	2	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Grasp the principles behind open-source software
2. Exhibit knowledge of various open-source software tools used in specific domains such as graphics and design, education, content management systems, content creation, etc
3. Know the process of contributing to open-source projects, including finding appropriate projects, understanding project structures
4. Exhibit knowledge of various software development methodologies within open-source environments

Office Suites:

- LibreOffice: A powerful office suite compatible with Microsoft Office formats.
- Apache OpenOffice: Another open-source office suite, similar to LibreOffice.

Graphics and Design:

- GIMP: GNU Image Manipulation Program, a powerful image editor.
- Inkscape: Vector graphics editor, similar to Adobe Illustrator.
- Blender: Open-source 3D creation software, useful for animation, modeling, and more.

Productivity and Collaboration:

- Nextcloud: A self-hosted productivity platform for file sharing, communication, and more.
- Zulip: Open-source team chat software with threaded conversations.
- Taiga: Project management platform for agile developers and designers.

Education:

- Moodle: Open-source learning management system for creating online courses.
- Open edX: Platform for creating and delivering online courses, used by institutions like Harvard and MIT.

Content Management Systems (CMS):

- WordPress: Open-source CMS for creating websites and blogs
- Joomla: Another popular CMS for publishing web content

Security and Privacy:

- OpenVPN: Open-source software for creating VPN (Virtual Private Network) connections.
- KeePassXC: Cross-platform password manager that stores passwords securely

E-commerce:

- Magento: Open-source e-commerce platform for building online stores

Content Creation:

- Audacity: Open-source audio editor and recorder

Syllabus for B. Tech. Semester IV
Department of Information Technology

Course Code	ITT4006				
Category	Humanities & Social Sciences Course				
Course Title	Cyber Laws and Ethics				
Scheme & Credits	L	T	P	Credits	Semester
	2	0	0	2	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

6. Correlate between national and international cyber laws
7. Analyze various cyber crimes
8. Apply various security measures for the prevention of cyber crimes
9. Apply ethical and moral behaviors when implementing and using Information Technology

Unit I

Introduction to Cyber laws: Cyber laws in India, International cyber laws.

Unit II

Cyber-crimes: classification, cyber-crimes against individuals, cyber-crimes against property, cyber-crimes against nation

Unit III

Introduction to cyber forensics: classification, digital evidence, Introduction to forensic tools

Unit IV

Intellectual property rights and related rights in Information Technology: Patent protection, copyright, database protection

Unit V

Electronic Privacy: Privacy and data protection, Access to electronic information

Unit VI

Ethics in IT: Ethics for IT workers and users, Ethics of IT organizations

Text Books

1. Cyber Forensics: Deje, Murugan, Oxford University Press .
2. Computer Law: Chris Reed, Oxford University Press, 7th Edition .

Reference Books

3. Ethics in Information Technology: George W. Reynolds, Cengage Learning ,5th Edition
- Cyber Laws and IT Protection: Harish Chander, PHI

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	MAT 4001				
Category	MDM				
Course Title	Linear Algebra				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Pre-requisite : Basic knowledge of Matrices and MAT 2002 (Discrete Mathematics)

Course Objective:

The objective of this course is to provide a foundational understanding and application of linear algebra concepts relevant to various aspects of computer science and related fields

Course Outcomes:

On successful completion of the course, student shall be able to

1. Check the consistency of system of equations and able to solve systems of linear equations by using Gaussian elimination method.
2. Determine which set is a vector space and able to find the basis elements of vector space.
3. Understand the fundamental concepts of linear transformations including mappings, kernel, image, null space, rank, and linear independence.
4. Find the orthogonal basis elements from given basis elements.
5. To find eigen values, eigen vectors and singular value decomposition of matrix

Syllabus

Module 1 (6 hours)

Row echelon form, Reduced row echelon form of Matrix, rank of matrix, system of Linear Equations.

Module 2: (8 hours)

Vector space, subspace, properties of subspaces, spanning set, Linearly independent and dependent vectors, Basis and dimensions of vector space.

Module 3: (6 hours)

Linear Transformation, range space and null space of Linear Transformation, Rank-Nullity Theorem, matrix representation of linear transformation.

Module 4: (8 hours)

Inner Product Spaces, Norm; Orthonormal Sets, Gram Schmidt orthogonalisation process, projections, positive definite matrices, QR decomposition.

Module 5: (8 hours): Eigen values and eigenvectors, diagonalization, spectral theorem of Matrix, Singular value decomposition, Least square method and introduction to PCA.

Text Books:

3. Hoffman and Kunze : Linear Algebra, Prentice Hall of India, New Delhi
4. Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007)

Reference Books:

3. Seymour Lipschutz et al: Linear Algebra, 3rded:Schaum series.
4. V. Krishnamoorthy et al : An introduction to linear algebra , Affiliated East West Press, New Delhi P.G. Bhattacharya, S.K. Jain and S.R.

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	ITT2990-1				
Category	Open Elective-II				
Course Title	Mobile Apps Development				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Analyze the different aspects of mobile app development
2. Design and develop mobile apps using Android as a development platform with a key focus on user experience design, native data handling, and background tasks and notifications
3. Apply the concept of Intent, Fragment, ListView, Progress bar, Seek bar and Rating bar
4. Apply the concepts of native hardware, location awareness, graphics, and multimedia in building real-world applications
5. Apply techniques of software testing and review
6. Perform testing signing, packaging, and distribution of mobile apps

Unit I: Getting Started with Mobility: Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development

Unit II: Building blocks of mobile apps: App user interface designing –mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity-state and life cycle, interaction amongst activities. App functionality beyond user interface – Threads, Async task, Services – States and life cycle, Notification, Broadcast receivers, Telephony and SMS APIs

Unit III: Working with View Groups, Building data with the AdapterView Class, Designing AutoTextView, Implementing Screen Orientation, Designing the views programmatically, Handling UI events, Creating Menus

Unit IV: Intents: Explicit Intents, Implicit intents, Fragments, Webview, ListView, Spinner, Alert Dialog, Rating Bar, Seek Bar, Progress Bar

Unit V: Sprucing up mobile apps: Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness and native hardware access (sensors such as accelerometer and gyroscope), Native data handling: On device file I/O, shared preferences, Mobile databases such as SQLite, and enterprise data access (via Internet /Internet)

Unit VI: Testing of Mobile App: Different levels of testing, different types of testing, Static Testing types, Dynamic Testing types, Debugging mobile apps, Test automation of mobile apps, Taking apps to market, Versioning, signing, and packaging mobile apps, distributing apps on mobile market place, Localization, Prework for publishing app

Text Books

1. Android Application Development all in one for Dummies - Barry Burd, 1st Edition, John Wiley and Sons
2. Teach Yourself Android Application Development 24 Hours- Lauren Darcy, 1st Edition, Pearson

Reference Books

1. Mobile Apps Development: Anubhav Pradhan, Anil V. Deshpande, 1st Edition, Wiley India
2. Foundations of Software Testing: Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, 2nd Revised Edition, Cengage Learning

Syllabus for B. Tech. IV Semester
Department of Information Technology

Course Code	HUT4003				
Category	HSSM				
Course Title	Managerial Economics				
Scheme & Credits	L	T	P	Credits	Semester
	2	0	0	2	IV

Course Outcomes

On successful completion, of course student will able to learn:

1. Gain basic knowledge of Economics to take managerial decisions.
2. Apply the knowledge of the mechanics of supply and demand to explain working of markets
3. To understand the concepts of production, cost, and revenue from a business perspective
4. To understand the various market types
5. Understand the concepts of macroeconomics for better understanding of the functioning of the economy for taking informed managerial decisions.

Syllabus:

UNIT 1: Introduction to Managerial Economics: (4 Hours)

Nature & scope of Managerial Economics: Concepts of Managerial Economics. Economic theory & Managerial theory. Role & responsibilities of Managerial Economists

UNIT 2: Micro Economics: (6 Hours)

Demand Analysis: Individual & market, Law of demand. Elasticity of demand its meaning and importance. Price elasticity, Income elasticity & Cross elasticity Using elasticity. in Managerial decisions Supply Analysis: Supply and Stock, Law of supply, supply function, determinants and elasticity of supply, Equilibrium of Demand and Supply.

UNIT 3: Theory of Production, Costs, and Revenue: (6 Hours)

Meaning of production, factors of production, laws of variable proportion, Economies and diseconomies of scale, Cost and Revenue concepts

UNIT 4: Market System: (6 Hours)

Meaning of Market, Types of market - Perfect Competition Market, Monopoly and Monopolistic market, Oligopoly, Duopoly

Unit 5: Macroeconomics for management (4 Hours)

Concepts and issues: Consumer Price Index, Wholesale Price Index, BOP, Current and Capital account, GDP, GNP, PI, Inflation, Business cycles, Monetary policy

Text Books:

1. Ahuja H.L., (2017) Managerial Economics, Analysis of managerial Decision making, S. Chand and company Limited, New Delhi, 9th ed.
2. Dwivedi D.N., (2015). Managerial Economics, Vikas publishing house Pvt. Ltd, Nodia, 8th ed.

Reference Books

1. Mankiw G., (2008) Principles of Economics (Kindle Edition) South Western Cengage Learning, Nodia 6th ed.
2. Salvatore, D., (2007) Managerial Economics. London: Oxford University Press, 6th ed.

Syllabus for B. Tech. IV Semester
Department of Information Technology
HONOR COURSE

Course Code	ITTH4100-1				
Category	Honor Course				
Course Title	Development of Progressive Web Applications				
Scheme & Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Understand progressive Web applications
2. Build responsive UI
3. Use web APIs
4. Optimize progressive Web applications
5. Test and deploy progressive Web applications

Unit 1: Introduction to PWAs: Understanding PWAs

Overview, significance, and difference from traditional web and mobile applications, Core Technologies: Overview of HTML5, CSS3, and JavaScript ES6, Building Blocks of PWAs: Introduction to Service Workers, Fetch API, Cache API, Promises, and Web App Manifest.

Unit 2: Building Responsive UI and Enhancing Offline Capabilities

Designing Responsive Layouts: Introduction to responsive design principles, media queries, and accessibility considerations. Offline First Approach: Understanding the offline-first concept, working with Service Workers for offline functionality. Advanced Service Worker Management: Lifecycle, fetch and cache management.

Unit 3: Native-Like Functionality

Introduction to Web APIs: Overview of Notification API, Background Sync API, and Web Payment API. Working with IndexedDB: Introduction to IndexedDB for client-side data storage, operations on IndexedDB. Implementing Push Notifications: Working with the Notification and Push APIs.

Unit 4: PWA Optimization Techniques

PWA Performance Optimization: Understanding the PRPL Pattern, code splitting and tree shaking techniques. Application Shell Architecture: Introduction and implementation of the App Shell Model. SEO & PWA: Best practices for making PWAs SEO friendly.

Unit 5: Testing and Deployment

Testing PWAs: Using tools like Lighthouse, Chrome DevTools for testing performance and PWA features. PWA Deployment: Overview of various deployment options and considerations for deploying PWAs. Future of PWAs: Upcoming features, trends and benefits of PWAs in the near future.

Refence Books:

1. Rojas, C. (2019). Building Progressive Web Applications with Vue. js: Reliable, Fast, and Engaging Apps with Vue. js. Apress.
2. Ater, T. (2017). Building progressive web apps: bringing the power of native to the browser. " O'Reilly Media, Inc."

Syllabus for B. Tech. IV Semester
Department of Information Technology
MINOR COURSE

Course Code	ITTM4100-1				
Category	Minor Course				
Course Title	Advanced Java Programming				
Scheme & Credits	L	T	P	Credits	Semester
	2	1	0	3	IV

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply J2EE architecture for the development of web applications.
2. Create dynamic web applications using JDBC.
3. Create dynamic web pages using Servlets and JSP.
4. Use the Struts framework.
5. Map Java classes and object associations to relational database tables with Hibernate mapping files.
6. Use Spring framework.

Unit I:

J2EE: J2EE architecture, Enterprise application concepts, n-tier application concepts, J2EE platform, HTTP protocol, web application, Web containers and Application servers, Set up Tomcat Container on a machine, Web application project structure

Unit II:

JDBC: Creating a Database and Tables, Getting Information from Database, Obtaining Result Set Information, Connecting a Java program to a Database, Prepared Statements and Statement Classes in Java, Inserting, Updating & Deleting Table data

Unit III:

Servlet: What is a Web Application, Java Servlets, What is a Servlet, Servlet Lifecycle, Servlet Context, Session management, Building the first servlet, Deploying the servlet, **JSP:** What is a JSP Page, Basic HTML Tags, JSP Tag Library, JSP Page Life cycle, Creating the first dynamic page using JSP MVC architecture, 3-tier architecture

Unit IV:

Struts: Introduction to MVC1, MVC2 Architecture, Overview of Struts Framework, Components of Model, View and Controller, Action Classes, Handling Application Requests, Generating Dynamic Views, Validating User Input, Validator Plug-in, Working with Tiles, Deployment Descriptors

Unit V:

Hibernate: Introduction to Hibernate, Object Related Mapping, Persistent Classes, Mapping Collections, Hibernate Query language, Caching and Transactions, Hibernate with web applications

Unit VI:

Spring: Introduction to Spring Framework, Spring Framework Architecture, Spring bean wiring, AOP with Spring, Transactions management, Spring with database

Text Book:

1. Database Programming with JDBC and Java 2e,
2. Head First Servlets and JSP, Kathy Sierra, Bryan Basham, Bert Bates, O'Reilly Media, Inc.
3. Spring in Action, Craig Walls, Manning Publication
4. Struts: The Complete Reference, James Holmes McGraw-Hill Education
5. Java Persistence with Hibernate, Gary Gregory, Christian Bauer, Manning Publication

Reference Book:

1. Spring Microservices in Action, John Cornell, Manning Publication
2. The Struts Framework: Practical Guide for Java Programmers, The Struts Framework: Practical Guide for Java Programmers, Sue Spielman, Morgan Kaufmann
3. Hibernate in Action, Christian Bauer and Gavin King, Manning Publication