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

2022-2023

B. TECH. (INFORMATION TECHNOLOGY)

Teaching Scheme for B.Tech. Information Technology

SEMESTER -I											
								Maximum Marks			ESE Duration (Hrs)
Sr. No.	Category	Course Code	Course Name	Hours/week			Credit	Continuous Evaluation	End Sem Exam	Total	
				L	T	P					
01	BSC	PHT159	Introduction to Quantum Computing	3	1	0	4	40	60	100	03
02	BSC	PHP159	Introduction to Quantum Computing Lab	0	0	2	1	25	25	50	-
03	BSC	MAT153	Mathematics-I	3	0	0	3	40	60	100	03
04	BSC	MAP153	Mathematics-I Lab	0	0	2	1	25	25	50	-
05	ESC	ITT151	Fundamentals of Programming	3	0	0	3	40	60	100	03
06	ESC	ITP151	Fundamentals of Programming Lab	0	0	2	1	25	25	50	-
07	ESC	ITT152	Digital Circuits	2	1	0	3	40	60	100	03
08	ESC	ITP152	Digital Circuits Lab	0	0	2	1	25	25	50	-
09	MC	HUT152	Constitution of India	2	0	0	0	-	-	-	-
10	MC	PEP151	Yoga/Sports	0	0	2	0	-	-	-	-
TOTAL				**13**	**02**	**10**	**17**				
				25 Hrs.							

SEMESTER –II											
Sr. No.	**Category**	**Course Code**	**Course Name**	**Hours/week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
01	ESC	ITT153	Object Oriented Programming	3	1	0	4	40	60	100	03
02	ESC	ITP153	Object Oriented Programming Lab	0	0	2	1	25	25	50	-
03	PCC	ITT154	Data Structures	2	1	0	3	40	60	100	03
04	PCC	ITP154	Data Structures Lab	0	0	2	1	25	25	50	-
05	ESC	ITP155	IT Workshop Lab -I	0	0	4	2	25	25	50	-
06	BSC	CHT154	Chemistry	2	0	0	2	40	60	100	03
07	BSC	CHP154	Chemistry Lab	0	0	2	1	25	25	50	-
08	BSC	MAT154	Mathematics-II	3	1	0	4	40	60	100	03
09	HSSM	HUT151	English	2	0	0	2	40	60	100	03
10	HSSM	HUP151	English Lab	0	0	2	1	25	25	50	-
11	ESC	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1				
TOTAL				**13**	**03**	**12**	**22**				
				28 Hrs.							

SEMESTER -III											
Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	PCC	ITT261	Computer Organization and Architecture	3	0	0	3	40	60	100	03
02	PCC	ITT262	Advanced Data Structures	2	1	0	3	40	60	100	03
03	PCC	ITP262	Advanced Data Structures Lab	0	0	2	1	25	25	50	-
04	PCC	ITT263	IT Infrastructure Services	2	0	0	2	40	60	100	03
05	PCC	ITP263	IT Infrastructure Services Lab	0	0	2	1	25	25	50	-
06	ESC	ITT264	Cyber Laws and Ethics	2	0	0	2	40	60	100	03
07	PCC	ITT265	Computer Graphics	2	1	0	3	40	60	100	03
08	PCC	ITP265	Computer Graphics Lab	0	0	2	1	25	25	50	-
09	BSC	MAT252	Linear Algebra & Statistics	3	0	0	3	40	60	100	03
10	HSSM	HUT254	Technical Communication	3	0	0	3	40	60	100	03
11	MC	CHT251	Environmental Science	2	0	0	0	-	-	-	-
TOTAL				**19**	**02**	**08**	**22**				
				29 Hrs.							

SEMESTER – IV											
Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	PCC	ITT266	Formal Languages and Automata Theory	2	1	0	3	40	60	100	03
02	PCC	ITT267	Software Engineering	3	0	0	3	40	60	100	03
03	PCC	ITP267	Software Engineering Lab	0	0	2	1	25	25	50	-
04	PCC	ITT268	Design and Analysis of Algorithms	3	0	0	3	40	60	100	03
05	PCC	ITP268	Design and Analysis of Algorithms Lab	0	0	2	1	25	25	50	-
06	PCC	ITT269	Database Management System	3	0	0	3	40	60	100	03
07	PCC	ITP269	Database Management System Lab	0	0	2	1	25	25	50	-
08	OEC	ITT299	Open Elective – I	3	0	0	3	40	60	100	03
09	BSC	MAT281	Discrete Mathematics	3	0	0	3	40	60	100	03
10	MC	HUT252	Indian Traditional Knowledge	2	0	0	0	-	-	-	-
TOTAL				**19**	**01**	**06**	**21**				
				26 Hrs.							

Open Elective – I	
Course Code	**Course Name**
ITT299-05	Web Development

SEMESTER – V											
Sr. No.	**Category**	**Course Code**	**Course Name**	**Hours/week**			**Credits**	**Maximum Marks**			**ESE Duration (Hrs)**
				L	**T**	**P**		**Continuous Evaluation**	**End Sem Exam**	**Total**	
01	PCC	ITT371	Compiler Design	3	1	0	4	40	60	100	03
02	PCC	ITT372	Operating Systems	3	0	0	3	25	25	50	-
03	PCC	ITP372	Operating Systems Lab	0	0	2	1	25	25	50	-
04	PCC	ITT373	Computer Networks	3	0	0	3	40	60	100	03
05	PCC	ITP373	Computer Networks Lab	0	0	2	1	25	25	50	-
06	PCC	ITT374	Introduction to Machine	2	1	0	3	40	60	100	03
07	PCC	ITP374	Introduction to Machine Learning Lab	0	0	2	1	25	25	50	-
08	OEC	ITT398	Open Elective– II	3	0	0	3	40	60	100	03
09	PROJC	ITP375	Project -I	0	0	4	2	50	50	100	
10	HSSM	HUT354	Managerial Economics	2	0	0	2	40	60	100	03
TOTAL				**16**	**02**	**10**	**23**				
				28 Hrs.							

Open Elective – II	
Course Code	**Course Name**
ITT398-05	Mobile Apps Development

SEMESTER -VI											
Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	PCC	ITT376	Cryptography and Network Security	3	0	0	3	40	60	100	03
02	PCC	ITT377	Artificial Intelligence	2	1	0	3	40	60	100	03
03	PCC	ITP377	Artificial Intelligence Lab	0	0	2	1	25	25	50	-
04	PCC	ITT378	Cloud Computing	2	1	0	3	40	60	100	03
05	PCC	ITP378	Cloud Computing Lab	0	0	2	1	25	25	50	-
06	PEC	ITT379	Elective-I	3	0	0	3	40	60	100	03
07	OEC	ITT399	Open Elective– III	3	0	0	3	40	60	100	03
08	PCC	ITP380	IT Workshop Lab-II	0	0	4	2	25	25	50	-
09	HSSM	HUT358	Organizational Behavior	2	0	0	2	40	60	100	03
10	PROJC	ITP381	Project-II	0	0	6	3	75	75	150	-
TOTAL				**15**	**02**	**14**	**24**				
				31 Hrs.							

Elective-I	
Course Code	**Course Name**
ITT379-01	Customer Relationship Management
ITT379-02	Product and Project Management

Open Elective – III	
Course Code	**Course Name**
ITT399-05	Open-Source Technologies

SEMESTER – VII											
Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	PCC	ITT481	Software Architecture	3	0	0	3	40	60	100	03
02	PEC	ITT482	Elective-II	3	1	0	4	40	60	100	03
03	PEC	ITP482	Elective-II Lab	0	0	2	1	25	25	50	-
04	PEC	ITT483	Elective-III	3	1	0	4	40	60	100	03
05	PEC	ITP483	Elective-III Lab	0	0	2	1	25	25	50	-
06	OEC	ITT498	Open Elective-IV	3	0	0	3	40	60	100	03
07	PROJC	ITP484	Industry Internship Evaluation*	0	0	2	1	-	-	-	-
08	PROJC	ITP485	Project-III	0	0	6	3	75	75	150	-
TOTAL				**12**	**02**	**12**	**20**				
				29 Hrs.							

***6-8 weeks Internship must be completed before reaching VII Semester**

Elective-II		Elective-III	
Course Code	**Course Name**	**Course Code**	**Course Name**
ITT482-01	Frontend Technologies	ITT483-01	Backend Technologies and DevOps
ITT482-02	Internet of Things (IoT)	ITT483-02	Mobile Application Development

Open Elective – IV	
Code	**Course Name**
ITT498-05	Introduction to Cybersecurity

SEMESTER – VIII											
Sr. No.	Category	Course Code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
01	PEC	IDT457/ ITT486	Elective-IV	3	0	0	3	40	60	100	03
02	PEC	ITT487	Elective-V	2	1	0	3	40	60	100	03
03	PEC	ITP487	Elective-V Lab	0	0	2	1	25	25	50	-
04	PEC	ITT488	Elective-VI	2	1	0	3	40	60	100	03
05	PEC	ITP488	Elective-VI Lab	0	0	2	1	25	25	50	-
			TOTAL	**07**	**02**	**04**					
				13 Hrs.			**11**				

OR

Sr. No.	Category	Course Code	Course Name	Hours/week	Credits	Maximum Marks			ESE Duration (Hrs.)
						Continuous Evaluation	End Sem Exam	Total	
01	PR	ITP460	Full Semester Internship		11	100	100	400	-

Elective-IV		Elective-V	
Course Code	**Course Name**	**Course Code**	**Course Name**
IDT457	Bioinformatics	ITT487-01	Image Processing
ITT486	Nature Inspired AI	ITT487-02	Data Warehouse and Mining

Elective-VI	
Code	**Course Name**
ITT488-01	Information Retrieval
ITT488-02	Digital Forensics

Scheme of Teaching & Examination of HONORS 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	ITTH301	Introduction to Web3 Programming	3	-	-	3	40	60	100	03 Hrs.
02	IV	ITTH401	Development of Progressive Web Application	3	-	-	3	40	60	100	03 Hrs.
03	V	ITTH501	Cloud Native App Development	4	-	-	4	100	-	100	-
04	VI	ITTH601	Introduction to DevOps	4	-	-	4	100	-	100	-
05	VII	ITPH701	Project	-	-	08	4	50	50	100	-
			Total	**14**	**-**	**08**	**18**			**500**	

*** Note: In case any of the above motioned courses are offered by the parent department, another course will be offered in lieu of that course.**

The Scheme of Teaching & Examination of MINORS 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	ITTM301	Web Designing	2	1	-	3	40	60	100	03 Hrs.
02	IV	ITTM401	Advanced Java Programming	2	1	-	3	40	60	100	03 Hrs.
03	V	ITTM501	Mobile App Development	3	1	-	4	40	60	100	03 Hrs.
04	VI	ITTM601	Amazon Web Services	3	1	-	4	40	60	100	03 Hrs.
05	VII	ITTM701	Project			08	4	50	50	100	
				08	**08**	**08**	**18**			**500**	

***Note: In case any of the above motioned courses are offered by the parent department, another course will be offered in lieu of that course.**

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

Course Code	PHT159				
Category	Basic Science Course				
Course Title	Introduction to Quantum Computing				
Scheme& Credits	L	T	P	Credits	Semester I
	3	1	0	4	

Course Outcomes
After successful completion of the course, the students will learn,

1. Quantum mechanics as applied in Quantum computing
2. Basics of complex vector spaces
3. Fundamentals of Quantum computations
4. Architecture and algorithms

Module 1: Basic Quantum Theory

(This unit will help the students to understand the electron and its state in quantum well and so in atoms which is acting as a storage device in quantum computers)

Brief introduction about Quantum Computers and Quantum mechanics, Schrodinger's time dependent equation, Wave nature of Particles, expectation values, variance, standard deviation, probability density, Stationary states, Infinite square well, Energy and Eigen value of electron in Infinite Potential well, Uncertainty principle

Module 2: Complex Vector Spaces

(This unit deals with matrix and its properties (real and complex) and transformation between the quantum state using tensors)

Algebra and Geometry of Complex numbers, Real and Complex Vector Spaces, definitions, properties, basis and dimensions, Generalization to n-dimensional space.

Module 3: Linear Algebra in Quantum Computing

(This unit deals with actual energy values of electron and electron states and properties related to change of state of electron with respect to energy and position, degeneracy with respect to it)

Inner products, Hilbert Spaces, Eigenvalues and Eigenvectors, Hermitian and Unitary Matrices, Tensor Product, Applications of linear algebra in computer graphics, Geometric transforms, Positioning the virtual camera

Module 4: Classical and Quantum Systems

(This unit differentiate between quantum approach of computer design from classical computers)

Deterministic and Probabilistic Systems, Quantum Systems, Observations, Quantum measurement principles, Stochastic matrices, Probabilistic double slit experiment with photons, Entangled states, Quantum clocks

Module 5: Architecture

(This unit deals with one-to-one relation between classical and quantum computers)

Bits and Qubits, Classical Gates, Reversible Gates, Quantum Gates, Toffoli and Fradkin Gates, Bloch Sphere, Deusch Gate, No-cloning theorem, Applications in Cryptography and Quantum teleportation

Module 6: Quantum algorithms

(This unit is forming a basic platform for students in implementing quantum algorithm in various application)

Deutsch's algorithm, The Deutsch-Jozsa algorithm, Simon's periodicity algorithm, Grover's search algorithm, Shor's factoring algorithm, Quantum Fourier Transform. Applications of quantum computing in 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

Course Code	PHP159				
Category	Basic Science Course				
Course Title	Introduction to Quantum Computing Lab				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes:
The physics laboratory will consist of experiments and programming exercises illustrating the principles of physics relevant to the study of computer science and engineering. During the training in the Physics Lab, the students will be able,

1. To develop skills for experimental verification of physics laws using mathematical models and simulation.
2. To analyze the results using the mathematical tools
3. To learn the computational techniques
4. To interpret the mathematical and computational outcomes from the simulations.

The laboratory will consist of general physics experiments and computational physics practicals.

General Physics

1. Measuring scales and error estimation
2. Verification of Ohm's law and linear least square fitting method
3. Verification of Newton's law of cooling
4. Simple harmonic motion
5. Measurement, analysis and fitting of non-linear IV characteristics of PN junction diode

Computational Physics

1. Linear least square fit method for data analysis
2. Solving 1D Schrodinger Wave Equation for a free and a bound particle and for barrier tunnelling.
3. Superposition of two wavefunctions for 1D and 2D Potential.
3. Plotting of Plank's function and verification of Stefan's law
4. Finding inverse, norm and inner products, rank of a matrix, Tensors
5. Introduction to quantum computing packages (GitHub repository)
6. Implementation of Deutsch-Josza algorithm using Cirq library

Reference Books

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

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

Course Code	MAT153				
Category	Basic Science Course				
Course Title	Mathematics-I				
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 ordinary differential equation, statistics, probability and Matrices. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that modelphysical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Module 1: First order ordinary differential equations(7 hours)

Exact,linearandBernoulli'sequations,Euler'sequations,Equationsnotoffirstdegree:equationssolvablef or p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3: Basic Statistics: (7 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: Basic Probability: (8 hours)

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

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley- Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
2. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory& Problems of probability and statistics: 2nd ed :J. R. Spiegal, Schaumseries
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, AFirst Course in Probability, 6th Ed., Pearson Education India, 2002.

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

Course Code	MAP153				
Category	Basic Science Course				
Course Title	Mathematics-I Lab				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Course Outcomes

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. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real-time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The

Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

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

Course Code	ITT151				
Category	Engineering Science Course				
Course Title	Fundamentals of Programming				
Scheme& Credits	L	T	P	Credits	Semester I
	3	0	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 (disks, memory, processor, where a program is stored and executed, operating system, compilers, etc.). Algorithm and Flowchart for problem-solving with Sequential Logic Structure. Steps to solve logical and numerical problems. Representation of Algorithm, Flowchart / Pseudo code with examples.

Unit II: Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Decision Control Statement-if, if-else, nested if-else statement, switch case, Loops and Writing and evaluation of conditionals and consequent branching, Pre-processor Directives.

Unit III:
Concept of functions, User defined and Library Functions, parameter passing and returning type, Recursion, Storage classes. Pointers and Function Arguments, Pointer Arithmetics, and Pointer operators.

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

Unit V: Structures, Simple structures, Array of Structures, Use of Pointers in referencing structures, the notion of linked list (no implementation), malloc and calloc functions of C.

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	ITP151				
Category	Engineering Science Course				
Course Title	Fundamentals of Programming Lab				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Minimum 10 Practicals based on Course Outcomes

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.

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

Course Code	ITT152				
Category	Engineering Science Course				
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, 4 edition by Tata McGraw Hill

2. Digital Logic Design: M. Mano, 2 edition. Pearson

Reference Books:

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

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

Course Code	ITP152				
Category	Engineering Science Course				
Course Title	Digital Circuits Lab				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Minimum 10 Practical's based on the course

Course Outcomes

Upon completion of the course, students will be able to

1. Design combinational circuits
2. Design sequential circuits.
3. Design basic memory elements
4. Design Counters

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

Course Code	HUT152				
Category	Mandatory Course				
Course Title	Constitution of India				
Scheme& Credits	L	T	P	Credits	Semester I
	2	0	0	0	

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy– Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India.
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, Lexis Nexis

Syllabus for B. Tech. Semester I
Department of Physical Education

Course Code	PEP151				
Category	Mandatory Course				
Course Title	Yoga / Sports				
Scheme& Credits	L	T	P	Credits	Semester I
	0	0	2	0	

Course outcome

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

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health-related physical fitness.
3. Develop body-mind coordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, PhysicalEducation Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. Theobjective would also be to make the all-round development with team spirit, social values as well as to identifyand develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an importantneutralizer for stress. Additionally, the objective would be to evaluate the health-related fitness of students so asto recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Program Outline

Sports:

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries andillness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

Yoga: Includes various sitting, standing and lying Asanas, Surya namaskars and Pranayamas.

Physical Efficiency Tests: This includes 6 health related physical fitness tests.

Components	**Name of Tests**
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M)/Shoulder strength (F)	Bent Knee Sit-ups (M)/Modified Pull-ups (F)
Yogic exercises	Surya namaskars

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

Course Code	ITT153				
Category	Engineering Science Course				
Course Title	Object Oriented Programming				
Scheme& Credits	L	T	P	Credits	Semester II
	3	1	0	4	

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 (overloading, polymorphism) 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–OrientedProgramming:AnEvolutionaryApproach",Addison–Wesley
2. Design Patterns By ErichGamma, 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	ITP153				
Category	Engineering Science Course				
Course Title	Object Oriented Programming Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Minimum 10 Practical based on Course Outcomes

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.

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

Course Code	ITT154				
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: Concept of data types, algorithms, and their features. Analysis of Algorithms, Asymptotic notations, Features of a structured program, Recursion, and Introduction to algorithm design techniques.

Unit II

Arrays: Introduction, Memory Representation, Introduction to Stacks & Queues. Application of array in implementation of structures like stacks, queues, De-queues, and Priority queues. Concept and representation of Sparse matrices and basic operations on them.

Unit III

Linked List: Purpose and representation in memory. Implementation of Single and doubly linked lists and basic operations on them. Applications of linked list: Polynomial operations, Equivalence relation, Generalized lists, Memory Management.

Unit IV

Sorting: Internal and external sorting, Bubble sort, Exchange sort, Insertion sort, Selection sort, Radix sort Merge sort, Quick sort, and Heap sort.
Searching: Sequential, Binary, Indexed search, Hashing techniques, and Collision-handling mechanisms.

Unit V

Trees: Definition and terminologies. Memory representation of binary trees. Tree traversal techniques, Threaded binary trees, Binary search trees, and Heap trees.

Unit VI

Graphs: Definition and terminologies. Implementation in memory. Graph traversal technique, Minimum CostSpanning Trees computation, and Shortest Path algorithm.

Text Books

1. Fundamentals of Data Structures in C: E. Horowitz, S. Sahani and Anderson- Freed, UniversityPress, 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	ITP154				
Category	Program Core Course				
Course Title	Data Structure Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Minimum 10 Practical based on the course ITT153

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

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

Course Code	ITP155				
Category	Engineering Science Course				
Course Title	IT Workshop Lab-I				
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. Use macros in MS Excel.
3. Design static web pages using basic HTML tags.
4. Apply CSS in HTML pages.
5. Use popular IDEs for program development.

MS Excel, Macros

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

Study of popular IDEs: NetBeans IDE, Ellipse IDE

Text Book

1. Linux Pocket guide- Daniel J. Barrett, O'Reilly Media
2. Linux: The Complete Reference, Sixth Edition- Richard Petersen, McGraw Hill Education

Reference Books

1. Linux Administration : A Beginner's Guide – Wale Soyinka , McGraw Hill Publication
2. Linux Command Line and Shell Scripting Bible- Richard Blum, Wiley

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

Course Code	CHT154				
Category	Basic Science Course				
Course Title	Chemistry				
Scheme& Credits	L	T	P	Credits	Semester II
	2	0	0	2	

Course Outcomes:
After the successful completion of the course, students shall be able to

- Predict the properties and interactions of chemical substances by understanding their composition at the atomic and molecular level.
- Discuss unique properties of nano-materials to solve challenges in our life and applications in computational world.
- Discuss how spectroscopic methods are used for qualitative and quantitative analysis.
- Analyze the utilization of green computing technology for environmental issues

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Syllabus:

Module 1: Atomic and Molecular Structure [6 hours]

Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. HOMO, LUMO, Crystal field theory and the energy level diagrams for transition metal ions and their optical and magnetic properties. Band Theory

Module 2: Nanomaterials for Advanced Computing: [6 hours]

Basics of Nanochemistry, classification, synthesis and Industrial applications, quantum dots for quantum computers, Doping of nanocrystals, Nanowires, Nanofibers, Nanotechnological advancements for computing.

Module 3: Characterization Techniques and computational tools: [6 hrs]

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.

Module 4: Green Computing and Chemistry [6 hrs]

Metal extraction from E-wastes: Constraints and opportunities, Chemical exposure (Lead, Mercury, Cadmium, Chromium etc.) and contamination, Principles of Green Chemistry and Green Computing, Role of Green Computing in Environment and Research, Green devices and Green data Server.

Suggested 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

Suggested Reference Books:

1. C. J. Cramer, Essentials of Computational Chemistry: Theories and Models, Second Edition, Wiley Interscience Publications.

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	CHP154				
Category	Basic Science Course				
Course Title	Chemistry Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Course Outcomes:

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: [Any six from the list]

[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

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. A. 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 Real World Problems, Wiley Interscience Publications

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

Course Code	MAT154				
Category	Basic Science Course				
Course Title	Mathematics-II				
Scheme& Credits	L	T	P	Credits	Semester II
	3	1	0	4	

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. 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 ofmathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve tool of power series and Fourier series forlearning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module 1: Calculus: (7 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin series expansions; Indeterminate forms and L'Hospital's rule; radius of curvature (Cartesian form), evolutes and involutes

Module 2:Multivariable Calculus (Differentiation) (8 hours)

Limit, continuity and partial derivatives, Eulers Theorem, chain rule , total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 3 Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracingof curves(Cartesian form)

Module 4:Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 5: Multivariable Calculus (Integration) (7 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by(double integration) Center of mass and Gravity (constant and variable densities).

Module 6 : Vector Calculus(7 hours)

Vector Differentiation, Directional derivatives, total derivative , Gradient, curl and divergence. Vector integration, Theorems of Green, Gauss and Stokes.

Topics for self-learning

Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation (Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area,surface areas and volumes of revolutions.

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. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

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

Course Code	HUT151				
Category	Humanities Social Science and Management				
Course Title	English				
Scheme& Credits	L	T	P	Credits	Semester II
	2	0	0	2	

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as wellas communication skills at workplace. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communications kills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
1.4 Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Redundancies
3.6 Cliches

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence

5. Writing Practices

5.1 Comprehension
5.2 Precis Writing
5.3 Essay Writing
5.4 Letter Writing
5.5 Email Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and Pushp Lata. 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 Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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

Course Code	HUP151				
Category	Humanities Social Science and Management				
Course Title	English Lab				
Scheme& Credits	L	T	P	Credits	Semester II
	0	0	2	1	

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills– listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation, Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations: Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

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

Course Code	IDT151				
Category	Engineering Science Course				
Course Title	Creativity, Innovation & Design Thinking				
Scheme& Credits	L	T	P	Credits	Semester II
	1	0	0	1	

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

Unit 1. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving.

Unit 2. Pattern Breaking : Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking, Mapping thoughts, Other(new approaches)

Unit 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional(8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

Unit4. Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, six thinking hats, Ethical considerations

Unit 5. Design for Innovation : Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

Unit 6.Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks®, Trade Secret, Unfair Competition.

Reference Books and Text Book

1. Creative Problem Solving for Managers- Tony Proctor- Rout ledge Taylor &Francis Group
2. 101 Activities for Teaching creativity and Problem Solving- By Arthur B Vangundy- Pfeiffer
3. H. S. Fogler and S.E. Le Blanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brainteasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, asystematic ideation method, reading(individual)
- 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. III Semester

Department of Information Technology

Course Code	ITT261				
Category	Program Core Course				
Course Title	Computer Organization and Architecture				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes

Upon completion of the course, student will be able to

1. Justify the need of various computer hardware units.
2. Design circuits for performing integer and floating-point arithmetic.
3. Design memory systems.
4. Exhibit knowledge of different bus structures and control unit.
5. Justify the need for different I/O handling techniques.
6. Apply concept of pipelining to enhance system performance.

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.

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

Course Code	ITT262				
Category	Program Core Course				
Course Title	Advanced Data Structures				
Scheme& Credits	L	T	P	Credits	Semester
	2	1	0	3	III

Course Outcomes

Upon completion of the course, students will be able to

1. Demonstrate the concepts of complexity and sorting techniques
2. Use Binary trees and multi-way trees for solving problems
3. Apply algorithms for solving problems using graphs
4. Apply various Text processing techniques
5. Exhibit knowledge of skip lists

Unit I

Performance of algorithms: Revision of Space and Time complexity analysis with examples, Revision of Asymptotic notations. External Sorting algorithms, sorting in linear time algorithms: Counting sort, Radix sort, Bucket sort

Unit II

Trees: Binary search tree (BST): Insertion and deletion of nodes in BSTs, AVL tree, Rotations, LL, RR, RL, LR rotations, Rotations for bigger trees, Insertion and Deletion operations with example.

Unit III
Trees: Comparison between AVL tree and RB tree, Red-Black Trees: Insertion and deletions, B trees and operations.

Unit IV Graphs: Revision of graphs, their types, The Floyd-Warshall algorithm, The Bellman-Ford algorithm, Johnson's algorithm for sparse graphs

Unit V
Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm.

Unit VI
Skip Lists: Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, Introduction to Algorithms, MIT Press.
2. A V Aho, J. D Ullman and J. E Hopcroft, Data Structures and Algorithms, Addison Wesley.
3. E. Horowitz, S. Sahni and S. Rajasekeran, Fundamentals of Computer Algorithms, University Press

Reference Books

1. E. Horowitz, S. Sahni and S. Anderson-Freed, Fundamental of data Structure in C, W.H. Freen Co.
2. Data Structures & Program Design in C: Robert Kruse, G. L. Tondo and B. Leung PHI-EEE.
3. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, Data Structures Using C.

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

Course Code	ITP262				
Category	Program Core Course				
Course Title	Advanced Data Structures Lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	III

Minimum 10 Practical based on the course ITP262

Course outcomes

Upon completion of the course, students will be able to

1. Find the complexity of algorithms
2. Use Binary trees and multi-ways trees for problem solving
3. Use graphs for problem solving
4. Apply various Text processing techniques.
5. Apply skip list for problem solving.

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

Course Code	ITT263				
Category	Program Core Course				
Course Title	IT Infrastructure Services				
Scheme& Credits	L	T	P	Credits	Semester
	2	0	0	2	III

Course Outcomes

At the end of the course, students will be able to

1. Justify the need for file system
2. Manage the users and groups on the system
3. Configure GRUB loader services
4. Apply the concept of Package and storage management
5. Write shell scripts
6. Configure important services on the Linux server

Unit I

Introducing Linux: History, Linux distribution, Linux basics: Linux vs Microsoft Windows, Linux Basic commands, Linux file system, File handling commands, file permissions.

Unit II

Users and Groups: Working with Users and Groups.

Startup and Services: Linux booting process, Services, and Processes, GRUB boot loader, Managing services.

Unit III

Package Management: Introduction to Package Management, Package Management commands.
Storage management: Storage basics, Fdisk command Logical volume management.

Unit IV

Shell script and shell programming

Unit V

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

Unit VI

Web services: Apache web Server, File, and print sharing: File sharing with Samba and NFS, Managing documents, Print servers.

Backup and Recovery: Disaster recovery planning, Backup process, and configuring backup process using backup and recovery tools.

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, TMH Publication

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

Course Code	ITP263				
Category	Program Core Course				
Course Title	IT Infrastructure Services Lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	III

Minimum 10 Practical based on the course ITT153

Course outcomes

Upon completion of the course, students 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 Linux server.

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

Course Code	ITT264				
Category	Engineering Science Course				
Course Title	Cyber Laws and Ethics				
Scheme& Credits	L	T	P	Credits	Semester
	2	0	0	2	III

Course Outcomes

Upon completion of the course, students will be able to

1. Correlate between national and international cyber laws
2. Analyze various cyber crimes
3. Apply forensic techniques for solving cyber crimes
4. Apply various security measures for prevention of cyber crimes
5. Apply ethical and moral behaviors while using Information Technology

Unit I

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

Unit II

Cyber-crimes: classification, cyber-crimes against individual, cyber-crimes against property, cyber-crimes against nation.

Unit III

Introduction to cyber forensics: classification, digital evidence, 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: Dejey, Murugan, Oxford University Press
2. Computer Law: Chris Reed, Oxford University Press

Reference Books

1. Ethics in Information Technology: George W. Reynolds, Cengage
2. Cyber Laws and IT Protection: Harish Chander, PHI

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

Course Code	ITT265				
Category	Program Core Course				
Course Title	Computer Graphics				
Scheme& Credits	L	T	P	Credits	Semester
	2	1	0	3	III

Course Outcomes

Upon completion of the course, students will be able to

1. Exhibit knowledge of Graphics hardware
2. Implement basic Graphics Primitives using standard algorithms
3. Apply Two-Dimensional and Three-Dimensional transformations
4. Apply Clipping and Solid Area Scan Conversion Techniques on basic objects.
5. Exhibit knowledge of Curves and Surface Detection and their applications
6. Create a simple animation sequence through programming

Unit I

Introduction Computer Graphics: Introduction to Image and Objects, Image Representation, Basic Graphics Pipeline, Bitmap and Vector-Based Graphics, Applications of Computer Graphics, Display Devices, Input Technology, Coordinate System Overview.

Scan-Conversion of Graphic Primitives: Scan-Conversion of a Lines (Digital Differential Analyzer Algorithm), Bresenham's Line- Drawing Algorithm, Scan-Conversion of Circle and Ellipse (Bresenham's Method of Circle Drawing, Midpoint Circle Algorithm), Drawing Ellipses and Other Conics.

Unit II

Two-Dimensional Transformations: Introduction, Transformation Matrix, Types of Transformations in Two-Dimensional Graphics: Identity Transformation, Scaling, Reflection, Shear Transformations, Rotation, Translation, Rotation about an Arbitrary Point, Combined Transformation, Homogeneous Coordinates, 2D Transformations using Homogeneous Coordinates.

Unit III

Three-Dimensional Transformations: Homogeneous Coordinates, Three-Dimensional Scaling, Translation, Rotation, Shear Transformations, Reflection, World Coordinates and Viewing Coordinates, Projections: Parallel and Perspective Projections.

Unit IV

Viewing and Clipping: Introduction to viewing and viewing Transformation in Two Dimensions, Two-Dimensional Clipping, Line Clipping, Introduction to a Polygon Clipping, Viewing and Clipping in Three Dimensions, Three-Dimensional Viewing Transformations.
Solid Area Scan-Conversion: Inside - Outside Test, Winding Number Method and Coherence Property, Polygon Filling, Seed Fill Algorithm, Scan-Lino Algorithm, Priority Algorithm, Scan Conversion of Character, Aliasing, Anti-Aliasing, Halftoning, Thresholding and Dithering.

Unit V

Curves and surfaces: Spline representations, Bezier curves and surfaces, B-spline curves and surfaces. Visible surface detection methods: Back-face detection, depth buffer, A-buffer, Z-buffer, Scan-Line Illumination models and Surface rendering.

Unit VI

Introduction to Animation: Key-Frame Animation, Construction of an Animation Sequence, Motion Control Methods, Procedural Animation, Key-Frame Animation vs. Procedural Animation, Introduction to Morphing, Three-Dimensional Morphing.

Text Books

1. Procedural elements of Computer Graphics, David F. Rogers, TataMcGraw-Hill.
2. Computer Graphics, Donald Hearn and M. Pauline Baker, PrenticeHall of India.
3. Computer Graphics, Steven Harrington, McGraw-Hill.

Reference Books

1. Computer Graphics Principles and Practice, J.D. Foley, A VanDam, S. K. Feiner and R. L. Phillips, Addison Wesley.
2. Mathematical Elements of Computer Graphics, David F. Rogers, J.Alan Adams, Tata McGraw-Hill.
3. Computer Graphics with OpenGL, Hearn and Baker, Pearson.

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

Course Code	ITP265				
Category	Program Core Course				
Course Title	Computer Graphics Lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	III

Minimum 10 Practical based on the course ITT265

Course outcomes

Upon completion of the course, students will be able to

1. Write programs for the implementation of Graphics Primitives
2. Apply 2-D and 3-D Transformations on the given objects
3. Perform Viewing Transformations on the given object
4. Apply Line Clipping Algorithms against a given window in 2-D
5. Apply Solid Area Scan Conversion algorithms on the given polygon
6. Develop simple Animation Sequences using suitable Graphics library

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

Course Code	**MAT252**				
Category	Basic Science Course				
Course Title	Linear Algebra & Statistics				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes

On successful completion of the course, the students will learn:

1. Computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigen values and eigen vectors, orthogonality anddiagonalization.
2. Visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems and view solutions, especially in and, as well as conceptually extend these results to higher dimensions.
3. To prepare the background of students to pursue statistical theory or methodology and analyze data in any stream of computer science and information technology.

Module 1 (10-Lectures) :

Vector Space; Sub spaces; Linear Dependence/Independence; Basis; Dimension; Linear transformation; Range Space and Rank; Null Space and Nullity; Rank nullity theorem, Matrix Representation of a linear transformation; Linear Operators on Rn and their representation as square matrices; Invertible linear operators; Inverse of a non-singular matrix.

Module 2 (8-Lectures):

Eigen values and eigenvectors of a linear operator; Inner Product Spaces, Norm; Ortho normal Sets, Gram Schmidt orthogonalisation process; projections, positive definite matrices, and Singular Value Decomposition.

Module 3 (13-Lectures):

Review of Discrete and continuous random variable, joint probability function, Introduction to stochastic process, random walk, stationary and auto regressive process, transition probability Matrix,Discrete time Markov chain, Continuous time Markov chain.

Module 4 (6-lectures) :

Hypothesis testing for sampling distributions of means, proportions, sum and differences of means and proportions for large and small samples.

Text Books

1. Hoffman and Kunze : Linear Algebra, Prentice Hall of India, New Delhi

2. Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007)
3. M R. Spiegal : Theory and Problems of probability and statistics :,2nd ed :, Schaum series

Reference Books

1. Seymour Lipschutz et al: Linear Algebra, 3rded:Schaum series.
2. V. Krishnamoorthy et al : An introduction to linear algebra , Affiliated East West Press, New Delhi
3. P. G. Bhattacharya, S. K. Jain and S.R. Nagpaul : First course in Linear Algebra, Wiley Eastern Ltd.,New Delhi
4. K. B. Datta : Matrix and Linear Algebra, Prentice Hall of India, New Delhi
5. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
6. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

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

Course Code	HUT254				
Category	Basic Science Course				
Course Title	Technical Communication				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	III

Course Outcomes

1. Students will understand the process and types of communication.
2. Students will understand the objectives of technical communication and role of audience in effective communication.
3. Students will learn basic grammar rules, develop technical writing skills and produce effective work placedocuments.
4. Students will understand the process of research writing and develop skills to write documents for higher studies.
5. Students will develop skills to enhance visual appeal of documents.
6. Students will understand strategies for effective oral communication for professional needs.

Unit 1 Technical communication

Definition, Barriers of Communication, Objectives of technical communication, Producing the product, Audience recognition and involvement.

Unit 2. Technical Writing

Process of Technical Writing, Types of Technical Writing Letters: Job application, Job Description and Resume, Sales, enquiry, complaint, order, follow-up letters, Organizational announcement, Minutes of the Meetings. Reports: Trip, Progress, Incident, Investigative, Feasibility/Recommendation reports

Unit 3. Grammar and Editing

Functional Grammar: Punctuations, Mechanics, Active/ Passive, Transformation of sentences

Unit 4.Orientation in Research

Writing proposals, SOP, writing articles for journals and conferences, abstract and executive summary, thesis writing

Unit 5. Preparation of Documents

Visual appeal: Document design, graphics, tables, poster presentations User manuals, Brochures, Fliers

Unit 6.Effective Oral Communication

Non- Verbal Communication, Public speaking, Presentations, Group Discussion and Interviews

Text Books

1. Gerson and Gerson, “Technical Communication: Process and Product”, 2018, Pearson
2. Meenakshi Raman and Sangeeta Sharma, “Technical Communication: Principles and Practice”, 2015,Oxford University Press

Reference Books

1. S. Kumar and Pushplata, “Communication Skills”, 2016, Oxford University Press
2. C. Muralikrishna and Sunita Mishra, “Communication Skills for Engineers”, 2016, Pearson
3. Andrea Rutherfoord, “Basic Communication Skills for Technology”, 2012,Pearson
4. Barun K Mitra, “Effective Technical Communication: A Guide for Scientists and Engineers”, 2006, Oxford

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

Course Code	CHT251				
Category	Basic Science Course				
Course Title	Environmental Science				
Scheme& Credits	L	T	P	Credits	Semester
	2	0	0	(0) Audit Course	III

Course Outcomes

On successful completion of the course, the students:

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual's outlook, so as to perceive our environmentalissues correctly, using practical approach based on observations and self-learning.
3. Will become conversant with recent waste management techniques such as E-wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated withthese problems and greener efforts to be adopted, to protect the environment from gettingpolluted.

Principle of contaminant behavior and recent trends in environmental pollution control I- Airpollution and its control techniques: (4lectures)

Contaminant behavior in the environment, Air pollution due to SOx, NOx, photochemical smog,Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).

Techniques to control Air pollution, ambient air quality and continuous air quality monitoring,Control measures at source, Kyoto Protocol, Carbon Credits.

1. Noise pollution and its control techniques: (2 lectures)

Introduction to noise pollution and its causes Noise pollution control: Recent advances in noisepollution control and benefits.

2. Soil pollution and its control techniques: (5 lectures)

Soil pollution: Soil around us, Soil water characteristics, soil pollution.

Solid waste management: Composting, vermi culture, landfills, hazardous waste treatment, bio remediation technologies, conventional techniques (land farming, constructed wetlands), and phyto remediation.

Degradation of xenobiotic in environment: Petroleum hydrocarbons, pesticides, heavy metals

3. Water pollution and its control techniques: (8 lectures)

Major sources of water pollution: Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics

Techniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal. Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

4. E-wastes (2 lectures)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

5. Environmental Sustainability: Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability

Green energy, green chemistry, challenges to green technology, advantage and disadvantages ofgreen processes, Eco mark certification- its importance and implementation

6. Different government initiatives(2lectures)

National ambient air quality standard 2009, Swacch bharat abhiyan, National afforestation program and Act- 2016, National river conservation plan, Formation of National Green Tribunal

Books Suggested

1. Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. PAarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth - Heinemann
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd. Sultan Chand & Company.
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. P. T. Anastas & J. C. Warner, Green Chemistry: Theory& practice, Oxford University Press
7. P. Thangavel & Sridevi, Environmental Sustainability: Role of Green technologies, Springer publications.

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

Course Code	ITTH301				
Category	HONOR COURSE				
Course Title	Introduction to Web3 Programming				
Scheme& Credits	L	T	P	Credits	Semester III
	3	0	0	3	

Course Outcomes

At the end of the course students 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.

Refence 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	ITTM301				
Category	MINOR COURSE				
Course Title	Web Designing				
Scheme& Credits	L	T	P	Credits	Semester III
	2	1	0	3	

Course Outcomes

At the end of the course, students will be able to

1. Understand the basic Internetworking concept and 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. Basictools of Internet accesses: Email, FTP, WWW etc, Internet Protocol- HTTP, FTP, SNMP, Emailprotocols – 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, Importing function definitions.

String and regular expression: Determining length, Comparing strings Manipulating string case,Padding

and striping a string. Counting characters and words.

Unit VI

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

Text Books

1. The Complete Reference HTML &XHTML :Thomas Powell, 3rd Edition, TMH.
2. 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

Course Code	ITT266				
Category	Program Core Course				
Course Title	Formal Language Automata Theory				
Scheme& Credits	L	T	P	Credits	Semester
	2	1	0	3	IV

Course Outcomes

At the end of the course, students will be able to

1. Design Finite automata for real-life problems
2. Construct the grammar for various models
3. Use the pushdown automaton model for the given language.
4. Make use of the Turing machine concept to solve the problems.
5. Demonstrate an understanding of complexity classes, unsolved problems ,and recursive function theory.

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 and 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 equivalencebetween 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 Normalization, Regular function, Recursive Functions.

Text Books

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

Reference Books

1. Introduction to Languages and the Theory of Automata: John C. Martin, McGraw Hill
2. Introduction to Automata Theory, Languages and Computation: J. E. Hopcroft, Rajeev Motwani, Pearson Education

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

Course Code	ITT267				
Category	Program Core Course				
Course Title	Software Engineering				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

Upon completion of the course, students would be able to

1. Apply different software development process models for projects.
2. Analyze the various estimation and risk techniques for software project development
3. Apply UML modelling to design diagrams for the project
4. Analyze Quality Assurance parameters and respective methodologies
5. Exhibit the knowledge of Software design fundamentals for software building
6. Apply the various testing methods for software development

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 Development: Agility, XP (Extreme Programming), Other Agile process models.

Unit II

Risk management - Risk strategies, Software risks, Risk identification, Risk refinement, RMMMSoftware project estimation and planning, Decomposition techniques, LOC and FP estimation, Effect estimation, Identification, Projection, Assessment, Management and monitoring, Software re-engineering, Requirement analysis, Tasks, Analyst, Software prototyping

Unit III

UML diagrams for designing: Use case Diagram, Sequence diagram, Activity diagram, Data Flow Diagram, 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- process, fundamentals, Effective modular Design, User interface design, Dash boards, Human factors, Human computer interface design, guidelines, standards.

Unit VI

Software quality assurance, Software quality factors, Quality metrics, Halstead's S/W science, Software testing - techniques, fundamentals, White box testing, Black box testing, Validationtesting, System testing, Debugging software maintenance maintainability, Maintenance tasks.

Text Books

1. Software Engineering: Roger S. Pressman, 7th Edition, TMH.
2. Software Engineering, Principles and Practices: Rajesh Narang, MGH.

Reference Books

1. Software Engineering: Kassem A. Saleh, India Edition, Cengage Learning.
2. Software Engineering: Schach, Special Indian Edition, TMH.

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

Course Code	ITP267				
Category	Program Core Course				
Course Title	Software Engineering lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Minimum 8 Practical based on the course ITP267

Course Outcomes

Upon completion of the course, students would be able to

1. Apply different software development processes for project development
2. Apply different estimation methods for the project development
3. Design different UML Diagrams using tools
4. Apply different testing strategies

Group activity: Mini Project Designing and Prototype building and Testing.

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

Course Code	ITT268				
Category	Program Core Course				
Course Title	Design and Analysis of Algorithms				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

Upon completion of the course, students will be able to

1. Justify the fundamental needs of algorithms and the reason for their analysis
2. Analyse the time and space complexity of various algorithms
3. Exhibit the 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 Al 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.
2. Fundamentals of Computer Algorithms: Horowitz, Sahani, Rajsekharam, Computer Science Press.
3. Fundamentals of Algorithms: Brassard, Bratley, Prentice Hall, India.

Reference Books

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

Course Code	ITP268				
Category	Program Core Course				
Course Title	Design and Analysis of Algorithms Lab				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Minimum 10 Practical based on the course ITT265

Course outcomes

Upon completion of the course, students will be able to

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

Course Code	ITT269				
Category	Program Core Course				
Course Title	Database Management System				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

Upon completion of the course, students will be able to

1. Exhibit the 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, Tuple and Domain Calculus, 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, Checkpointing.

Unit V

NoSQL Databases: Introduction, Differences from Relational Databases, Basic Schema and data types, Types of NoSQL Databases, Concepts of replication, distribution, sharding, and resilience, Use of NoSQL in Industry.

Object-Based Databases: Overview, Complex Data Types, Structures Types and Inheritance in SQL Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, implementing O-R features, Object-Relational Mapping, Object-Oriented versus Object-Relational Databases.

Unit VI

Data Storage for Modern High-Performance Business Applications: Implementing a Relational Database, implementing a Key/Value Store, implementing a Document Database, Column-Family Database, and Graph Database.

Text Books

1. Database Systems Concepts: Silberschatz, Korth, Sudarshan, McGraw-Hill
2. Advanced Database systems (Morgan Kaufmann)

Reference Books

1. Fundamentals of Database Systems: R. Elmasri, S.B. Navathe, Pearson Education
2. Seven databases in seven weeks: a guide to modern databases and the NoSQL movement. Perkins, L., Redmond, E., & Wilson, J. (2018). Pragmatic Bookshelf.

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

Course Code	ITP269				
Category	Program Core Course				
Course Title	Database Management System Lab				
Scheme& Credits	L	T	P	Credits	Semester
	0	0	2	1	IV

Minimum 10 Practical based on the course ITP269

Course Outcomes

At the end of the course, students 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. Implement the concept of PL/SQL
5. Implement the database using NOSQL.

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

Course Code	MAT281				
Category	Basic Science Course				
Course Title	Discrete Mathematics				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

Upon completion of the course, students will be able to

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Perform operations on discrete structures such as sets, functions and relations
3. Demonstrate understanding of various algebraic structures.
4. Apply the concept of lattices and Boolean algebra to switching circuits.
5. Model different problems in computer science using graphs.

Unit I

Relation and Function: Basic concepts of Set theory, Power set, some operations on Sets, Venn diagram, some basic set identities, Cartesian products. Properties of binary relation in a set, Relation matrix and the graph of the relation, Partition and covering of a set. Equivalence relations, Compatibility relations, Compositions of binary relations. Definition and composition of functions, inverse functions and characteristic function of a set.

Unit II

Mathematical Logic: Statement and notations, connectives, Negation, conjunction, disjunction, conditional & biconditional, statement formulas & truth tables. Tautologies, equivalence of formulas, Duality law, Tautological implications. Normal Forms -Principal disjunctive and principal conjunctive normal forms. Theory of inference for statement calculus. Theory of inference for predicate calculus.

Unit III

Algebraic Structures: Semigroups, monoids -(definition and examples), Group definitions and examples, Cyclic group, permutation groups, subgroups and homomorphism, co sets and Lagrange'stheorem and Normal subgroup.

Unit IV

Rings and field: Ring (definition and examples), sub-rings, Ring homomorphism, ideals and Quotient rings, polynomial rings. Finite field, Galois field, Integral domain.

Unit V

Lattice theory and Boolean Algebra: Lattices as partially ordered set, Definitions and examples, some properties of Lattices, Lattices as algebraic system, sub lattices, direct product, homomorphism, some special Lattices. Boolean Algebra: Definitions and examples, Application of Boolean Algebra to switching circuits.

Unit VI

Graph Theory: Properties, types of graphs, Operations of graphs, Subgraphs and Isomorphic graphs, Paths, cycles and connectivity, Eulerian and Hamiltonian graphs, shortest path problems, graph coloring, vertex coloring, edge coloring, graph covering, network flows.

Text Books

1. Combinatorial Mathematics: C. L. Liu& D. P. Mohapatra, 4th edition, Tata McGraw Hill.
2. Discrete Mathematics and Its Applications, Kenneth Rosen, 7th Edition, Tata McGraw Hill.
3. Discrete Mathematical Structures with Applications to Computer Science: J. P. Tremblay and R. Manohar, Tata McGraw-hill.

Reference Books

1. Discrete Mathematics: Babu Ram, Pearson Publication.
2. Discrete Mathematics: Kolman, Busby & Ross, Pearson Publication

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

Course Code	HUT252				
Category	Basic Science Course				
Course Title	Indian Traditional Knowledge				
Scheme& Credits	L	T	P	Credits	Semester
	2	0	0	0 (Audit Course)	IV

Course Outcomes

Students will have increased ability to understand the importance and application of:

1. Indian Knowledge system and its scientific approach
2. Indian philosophical tradition
3. Indian artistic tradition.
4. Traditional knowledge and protection of nature
5. The legality and its importance for the protection of Indian traditional knowledge

Syllabus

1. Basic Structure of Indian Traditional Knowledge : Vedas, Upavedas, Vedang, Upadang,scientific approach
2. Ecology and Indian Traditional Knowledge : Meaning, role, case studies
3. Intellectual Property Rights and Indian traditional Knowledge : Meaning, role in protection of Indian traditional knowledge, cases studies
4. Indian Philosophical traditions : Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches
5. Indian Artistic Traditions : Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, Nrityaevam Sahitya, case studies

Reference Material

1. R R Gaur, Rajeev Sangal, G P Bagaria, Human Values and Professional Ethics (Excel Books, New Delhi, 2010)
2. V. Sivaramakrishanan (ed.), Cultural Heritage of India – Course material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
3. Swami Jitatman and, Modern Physics and Vedant, Bharatiya Vidya Bhavan
4. Swami Jitatman and, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5. S.C. Chatterjee and D. M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984
6. Pramod Chandra, Indian Arts, Howard University Press, 1984
7. Krishna Chaitanya, Arts of India, Abhinav Publications,1987

Course Code	ITT299-05				
Category	Open Elective Course				
Course Title	Open Elective-I : Web Development				
Scheme& Credits	L	T	P	Credits	Semester
	3	0	0	3	IV

Course Outcomes

At the end of the course, students will be able to

6. Understand the basic Internetworking concept and technologies
7. Create web pages using HTML.
8. Plan, design and publish websites.
9. Write PHP scripts to handle HTML forms
10. 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. Basictools of Internet accesses: Email, FTP, WWW etc, Internet Protocol- HTTP, FTP, SNMP, Emailprotocols–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: UsingArrays to Group Related Values.

Unit V

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

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

Unit VI

Using Files, Sessions, cookies: Reading and Writing Files, Managing sessions and Using session variables, 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

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

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

Course Code	ITTH401				
Category	HONOR COURSE				
Course Title	Development of Progressive Web Applications				
Scheme& Credits	L	T	P	Credits	Semester IV
	3	0	0	3	

Course Outcomes

At the end of the course students 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	ITTM401				
Category	MINOR COURSE				
Course Title	Advanced Java Programming				
Scheme& Credits	L	T	P	Credits	Semester IV
	2	1	0	3	

Course Outcomes:

At the end of the course, students will be able to

1. Apply J2EE architecture for development of web applications.
2. Create dynamic web application 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