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 & SYLLABI
2023-24
B. TECH. (COMPUTER SCIENCE & ENGINEERING)

B. Tech. Computer Science and Engineering [2023-24]
Teaching & Evaluation Scheme [B. Tech CSE]

Semester-I

Sr. No.	Course Type	Course Code	Course Name	Hours/ week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BSC	CHT1001	Chemistry of Smart Materials	2	0	0	2	50	50	100	2
2.	BSC	CHP1001	Chemistry of Smart Materials Lab	0	0	2	1	50	-	50	-
3.	BSC	MAT1002	Calculus	3	0	0	3	50	50	100	3
4.	ESC	CST1001	Digital Electronics	3	0	0	3	50	50	100	3
5.	ESC	CSP1001	Digital Electronics Lab	0	0	2	1	50	-	50	-
6.	ESC	CST1002	Programming for problem solving	3	0	0	3	50	50	100	3
7.	ESC	CSP1002	Programming for problem solving Lab	0	0	2	1	50	-	50	-
8.	VSEC	CST1003	Computer Workshop – I	1	0	0	1	50	-	50	-
9	VSEC	CSP1003	Computer Workshop – I Lab	0	0	2	1	50	-	50	-
10	IKS	HUT1001	Foundational Literature of Indian Civilization	2	0	0	2	50	50	100	2
11.	CCA	PET1001	Sports-Yoga-Recreation	1	0	0	1	50	-	50	-
12.	CCA	PEP1001	Sports-Yoga-Recreation Lab	0	0	2	1	50	-	50	-
			TOTAL	**15**	**0**	**10**	**20**			**850**	**-**

B. Tech. Computer Science and Engineering [2023-24]
Teaching & Evaluation Scheme [B. Tech CSE]

Semester-II

Sr. No	Course Type	Course code	Course Name	Hours/ Week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BSC	PHT2001	Introduction to Quantum Computing	2	1	0	3	50	50	100	3
2.	BSC	PHP2001	Introduction to Quantum Computing Lab	0	0	2	1	50	-	50	-
3.	BSC	MAT2002	Discrete Mathematics	3	0	0	3	50	50	100	3
4.	BSC	MAP2001	Computational Mathematics Lab	0	0	2	1	50	-	50	-
5.	BSC	CHT2007	Bioinformatics	2	0	0	2	50	50	100	2
6.	ESC	CST2001	Object Oriented Programming	3	0	0	3	50	50	100	3
7.	ESC	CSP2001	Object Oriented Programming Lab	0	0	2	1	50	-	50	-
8.	PCC	CST2002	Computer Architecture	2	0	0	2	50	50	100	2
9.	VSEC	CST2003	Computer Workshop – II	1	0	0	1	50	-	50	-
10.	VSEC	CSP2003	Computer Workshop – II Lab	0	0	2	1	50	-	50	-
11.	AEC	HUT2002	English for Professional Communication	2	0	0	2	50	50	100	2
12.	AEC	HUP2002	English for Professional Communication Lab	0	0	2	1	50	-	50	-
13.	CCA	HUP0001	Liberal/Performing Art	0	0	2	1	50	-	50	-
14.	VEC	HUT2004	Foundational Course in Universal Human Values	1	0	0	1	50	-	50	-
			TOTAL	**16**	**0**	**12**	**23**			**1000**	**-**

Exit option : Award of UG Certificate in Major with 43 credits and an additional 8 credits.			
Exit Courses			
1	**Web Designer**	**Online/offline certification Course**	**8**
2	**IT Support Engineer**		**8**
3	**Certified Programmer (language learned in Sem-1 and/or Sem-2 [C,C++,Java, Python])**		**8**

Semester - III

Sr. No.	Course Type	Course Code	Course Name	Hours/ week				Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	CST3001	Data Structures	3	1	0	4	50	50	100	3
2	PCC	CSP3001	Data Structures Lab	0	0	2	1	50	-	50	-
3	PCC	CST3002	Theory of Computation	3	0	0	3	50	50	100	3
4	MDM	MAT3002	Probability and Statics	3	0	0	3	50	50	100	3
5	OE	CST2980	Open Elective-I	4	0	0	4	50	50	100	3
6	AEC	HUT3001	Business Communication	2	0	0	2	50	50	100	2
7	EEM	CSP3004	Idea Lab	0	0	4	2	50	-	50	-
8	VEC	CST3003	Cyber Laws and Ethic in IT	2	0	0	2	50	50	100	2
9	VSEC	CSP3005	Software Laboratory – I	0	0	4	2	50	-	50	-
			TOTAL	**17**	**1**	**10**	**23**			**750**	

Semester - IV

Sr. No.	Course Type	Course code	Course Name	Hours/ week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	PCC	CST4001	Operating Systems	3	0	0	3	50	50	100	3
2	PCC	CSP4001	Operating Systems Lab	0	0	2	1	50	-	50	
3	PCC	CST4002	Design and Analysis of Algorithms	3	0	0	3	50	50	100	3
4	PCC	CST4003	Software Engineering	3	0	0	3	50	50	100	3
5	PCC	CSP4003	Software Engineering Lab	0	0	2	1	50	-	50	
6	MDM	MAT4001	Linear Algebra	3	0	0	3	50	50	100	3
7	OE	CST2990	Open Elective-II	2	0	0	2	50	50	100	2
8	VSEC	CSP4004	Software Laboratory – II	0	0	2	1	50	-	50	
9	EEM	HUT4003	Managerial Economics	2	0	0	2	50	50	100	2
10	VEC	HUT4002	Environmental Education	2	0	0	2	50	50	100	2
11	CEP	CSP4005	Community Engagement Project	0	0	4	2	50	-	50	
			TOTAL	**18**	**0**	**10**	**23**			**900**	**-**

Exit option : Award of UG Diploma in Major with 89 credits and an additional 8 credits

Exit Courses			
1	**Application Development (Android)**	**Online/offline certification Course**	**8**
2	**Certified software Engineer (Devop)**		**8**

Semester - V

Sr. No.	Course Type	Course Code	Course Name	Hours/ week				Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PCC	CST5001	Database Management System	3	0	0	3	50	50	100	3
2.	PCC	CSP5001	Database Management System Lab	0	0	2	1	50	-	50	
3.	PCC	CST5002	Compiler Design	3	0	0	3	50	50	100	3
4.	PCC	CSP5002	Compiler Design Lab	0	0	2	1	50	-	50	
6.	PCC	CST5003	Artificial Intelligence	3	0	0	3	50	50	100	3
7.	PCC	CSP5003	Artificial Intelligence Lab	0	0	2	1	50	-	50	
8.	MDM	CST5004	Data Handling and Visualization	3	0	0	3	50	50	100	3
9.	MDM	CSP5004	Data Handling and Visualization Lab	0	0	2	1	50	-	50	
10.	PEC	CST5005	Program Elective-I	3	0	0	3	50	50	100	3
11.	OE	CST3980	Open elective-III	2	0	0	2	50	50	100	2
			TOTAL	**17**	**0**	**08**	**21**			**800**	

Semester - VI

Sr. No.	Course Type	Course code	Course Name	Hours/ Week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PCC	CST6001	Machine Learning	3	0	0	3	50	50	100	3
2.	PCC	CSP6001	Machine Learning Lab	0	0	2	1	50	-	50	
3.	PCC	CST6002	Computer Network	3	0	0	3	50	50	100	3
4.	PEC	CSP6002	Computer Network Lab	0	0	2	1	50	-	50	
5.	PCC	CST6003	Design Pattern	3	0	0	3	50	50	100	3
6.	PEC	CST6004	Program Elective –II	3	0	0	3	50	50	100	3
7.	PEC	CST6005	Program Elective –III	3	0	0	3	50	50	100	3
8.	PEC	CSP6005	Program Elective -III Lab	0	0	2	1	50	-	50	
9.	MDM	CST6006	Customer Relationship Management	2	0	0	2	50	50	100	2
10.	VSEC	CSP6007	Mini Project	0	0	4	2	25	25	50	
			TOTAL	**17**	**0**	**10**	**22**			**800**	

Exit option : Award of UG Degree in Major with 132 credits and an additional 8 credits

Exit Courses			
1	**Certified Network Engineer (CCNA,CISCO)**	**Online/offline certification Course**	**8**
2	**Certified Database Engineer (Oracle, DB2)**		**8**
3	**Certified Cloud Engineer (AWS, AZURE)**		**8**

Semester - VII

Sr. No.	Course Type	Course Code	Course Name	Hours/ Week				Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PCC	CST7001	Cloud Computing	3	0	0	3	50	50	100	3
2.	PCC	CSP7001	Cloud Computing Lab	0	0	2	1	50	-	50	
4.	PEC	CST7002	Program Elective-IV	3	0	0	3	50	50	100	3
5.	PEC	CSP7002	Program Elective-IV Lab	0	0	2	1	50	-	50	
6.	PCC	CST7003	Deep Learning	3	0	0	3	50	50	100	3
7.	PCC	CSP7003	Deep Learning Lab	0	0	2	1	50	-	50	
8.	MDM	CST7004	Financial Data Analysis	2	0	0	2	50	50	100	2
9	CEP	CSP7005	Major Project-1	0	0	8	4	50	50	100	
			TOTAL	**11**	**0**	**14**	**18**			**650**	**-**

Semester - VIII

Sr. No.	Course Type	Course code	Course Name	Hours/ week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PEC	CST8001	Program Elective-V	3	0	0	3	50	50	100	3
2.	PEC	CST8002	Program Elective-VI	3	0	0	3	50	50	100	3
3.	CEP	CSP8003	Major Project-2	0	0	12	6	50	50	100	
			OR								
1	PEC	CST8004	Research Methodology	3	0	0	3	50	50	100	3
2	PEC	CST8001	Program Elective-V	3	0	0	3	50	50	100	3
3	CEP	CSP8005	Research Project	0	0	12	6	50	50	100	
			OR								
								Continuous Evaluation	**Industry Evaluation**	**Total**	
1.	INTR	CSP8006	Industry Internship	0	0	24	12	100	100	200	

Electives Basket

Micro Specialization	Elective-I	Elective-II	Elective-III	Elective-IV	Elective-V	Elective-VI
AI/ML	Internet of Things	Image Processing	Natural Language Processing	Generative Adversarial Network	Reinforcement Learning	Robotics & Intelligent Systems
Distributed and Cloud Systems	Distributed Systems	Data Warehousing & Mining	Big Data Analytics	Blockchain and Distributed Ledger Technology	Smart Contract Essentials	Design and Development of Blockchain Applications
Security	Network Security	Intrusion Detection and Prevention System,	Basics of Ethical Hacking	Vulnerability Assessment and Penetration Testing	Cybersecurity: Risk Management	Cyber and Digital Forensics
General	System Design	Robotics Process Automation	Software Testing	Information Retrieval	Bioinspired Intelligent Systems	Social Network Analytics

Open Electives Basket

List of Open Electives		
Sr. No.	Course Code	Course Name
Open Elective-I	CST2980	Object Oriented Programming
Open Elective-II	CST2990	Web Development
Open Elective-III	CST3980	Cloud Computing

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: CHT1001 **Course: Chemistry of Smart Materials**

L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 2**

Course Outcomes

On successful completion of course student will learn:

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

UNIT-I: Smart Sensors and Materials

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

UNIT-II: Nanomaterials

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

UNIT-III: Characterization techniques and computational tools:

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

UNIT-IV: Green Computing and Chemistry

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

Text Books:

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

Reference Books:

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: CHP1001 **Course: Chemistry of Smart Materials Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 1**

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

The students will learn to:

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

List of Experiments:

[1] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.

[2] Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.

[3] Basic statistical analysis of results of neutralization of acid against the base and preparing acceptable graphs using software.

[4] Prediction of infrared/NMR spectral and analytical data of organic molecules using Computational Software.

[5] Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.

[6] To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find out order of the reaction and analysis of experimental data using Computational Software.

[7] Molecular docking of drugs using open computational software.

[8] Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software

[9] Use of open access software for the interpretation of various parameters of materials including drugs

[10] Estimation of Copper from PCB

Suggested Books/Reference Books:

1. S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.
2. J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.
3. 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 RealWorld Problems, Wiley Inter science

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: MAT1002 **Course: Calculus**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objective

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

Course Outcomes

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

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

Syllabus

Module 1 : (8 Lectures)

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

Module 2: (8 Lectures)

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

Module 3: (8 Lectures)

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

Module 4: (8 Lectures)

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

Module 5: (8 Lectures)

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

Textbooks/References

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering Course

Code: CST1001 **Course: Digital Electronics**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. Logic functions using Boolean algebraic theorems and techniques
2. Conventional combinational and sequential circuits including conversions of flip-flops.
3. The exploration of the semiconductor memories and programmable logic devices.
4. The basic concept of microprocessor with addressing mode and instruction set for programming.

SYLLABUS

UNIT-I

Basics of Digital Electronics

Motivation for digital systems: Logic and Boolean algebra, Number Systems. Logic Gates & Truth Tables, Demorgan's law, Minimization of combinational circuits using Karnaugh maps up to five variable. Map manipulation-essential prime implicants, non-essential prime implicants**.**

UNIT-II

Combinational Circuit Design

Design procedure: Multiplexers, Demultiplexer, Encoders, Decoders, Code Converters, Adders, Subtractor (Half, Full), BCD Adder/ Subtractor, ripple and carry look-ahead addition booth's Algorithm, bit-pair recoding, Integer Division- restoring and non-restoring division

UNIT-III

Sequential circuit Design-I

Storage elements, Flip-flops and latches: D, T, J/K, S/R flip-flops. Master Slave Conversion of one of type of F/F to another Sequential circuit. Analysis –Input equations, state table, and analysis with J-K Flip flops. Sequential circuit Design, Design procedure, designing with D & J-K Flip flop.

UNIT-IV

Sequential circuit Design-II

Counters, asynchronous and synchronous design using state and excitation tables. Registers & Shift registers., Mealey & Moore Machines

UNIT-V

Memory & Programmable logic Devices

Semiconductor RAM memories, Static and Dynamic Memories, ROM, higher order memory design, multi-module memories, Memory interleaving, , Secondary storage – Magnetic disk, Optical disk, PLA, PAL.

UNIT-VI

Fundamental of Microprocessor

Introduction to µp 8085, Addressing modes, Instruction set, Programming of µp 8085.

Course Outcomes

After successful completion of this course, the student will be able to,

1. Outline binary arithmetic operations and optimize Boolean functions using Karnaugh map (k- map) method.
2. Apply combinational circuits for realization of basic building blocks of conventional digital circuits.
3. Design sequential blocks like flip flops, counters, registers, simple finite state machine and similar circuits.
4. Describe the memory elements and combinational digital circuits implementation with programmable logic devices.
5. Use addressing modes and instruction set of target microprocessors for writing efficient assembly language programs.

Text Books

1. Morris Mano; Digital Logic Design; Fourth edition, McGraw Hill
2. R.P.Jain; Modern Digital Electronic; Fourth edition; Tata McGraw-Hill.
3. V.J.Vibhute; 8-Bit Microprocessor & Microcontrollers; fifth edition.

Reference books

1. A. Anand Kumar; Fundamental of Digital Electronics; Second Edition, PHI
2. A.P.Godse; Digital circuit & design; Technical Publications; 2009.
3. Ramesh Gaonkar; 8 bit Microprocessor; CBS Publishers; 2011.

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: CSP1001 **Course: Digital Electronics Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr Per Week **Total Credits: 1**

Course Outcome

On Successful completion of course, students will be able to:

1. Use logic gates for designing digital circuits
2. Implement combinational circuits using VHDL
3. Implement sequential circuits using VHDL
4. Apply the knowledge gained for their project work based on the hardware digital circuits

Practical based on above theory syllabus

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: CST1002 **Course: Programming for Problem Solving**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Outcomes

On successful completion of course student will learn:

1. Develop C programs from the algorithm for simple arithmetic and logical problems.

2. Design programs using conditional branching, iteration and recursion.

3. Formulate algorithm/programs using arrays, pointers, structures and I/O operations.

4. Design programs using matrix manipulation along searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart /Pseudo code with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements,

Pre-processor Directives, Decision Control Statement-if, if-else, nested if-else statement, switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

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. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code: CSP1002 **Course: Programming for Problem Solving Lab**

L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Outcomes

On successful completion of course student will be able to:

1. Create C programs using loops and decision making statements to solve and execute the given problem.
2. Develop programs and functions one dimensional and two dimensional arrays.
3. Apply the concept of pointers, structures to develop programs.
4. Implement files in C to store the data for the given problem.

Practical based on above theory syllabus

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code : CST1003 **Course : Computer Workshop-1**

L: 1 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 1**

Course Objectives

1. Understand the definition and principles of UI/UX in order to design with intention.
2. Achieve an understanding of the life-cycle of application design—the process, purpose, and tools.
3. Learn the basics of HCI (human-computer interaction) and the psychology behind user decision- making.
4. Explore UI/UX tools to interpret requirements of modern applications.
5. Elaborate design decisions through presentations of assignments.

Unit 1:

UI/UX Overview: Introduction to UI/UX, Principles of UI/UX, UI Components, Design Thinking, Interaction Design, Usability.

Unit 2:

UI Programming: Basic of HTML5, Elements of HTML5, Background of CSS, Bootstrap CSS, Fundamentals of JavaScript, HTML DOM Manipulations.

Unit 3:

UX Programming: Figma Basics, How to identify user needs, Wireframe and Prototype, Digital Storytelling.

Course Outcomes

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

1. Understand basics of UI/UX
2. Design and develop web pages using HTML, CSS and JavaScript
3. Infer the significance of Wireframing and build prototypes.

Text Books

1. UI/UX design for designer and developers: by Nathan Clark
2. Web Design: A Beginner's Guide Second Edition by Wendy Willard
3. User story mapping by Jeff Patton, O'Reilly Publication

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code : CSP1003 **Course : Computer Workshop-1 Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits: 1**

Course Objectives

1. Understand the definition and principles of UI/UX in order to design with intention.
2. Achieve an understanding of the life-cycle of application design—the process, purpose, and tools.
3. Learn the basics of HCI (human-computer interaction) and the psychology behind user decision- making.
4. Explore UI/UX tools to interpret requirements of modern applications.
5. Elaborate design decisions through presentations of assignments.

Syllabus:

Practical based on Theory Syllabus

Course Outcomes

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

1. Design and develop static web pages using HTML and CSS
2. Develop dynamic web pages using JavaScript
3. Create high-fidelity designs and prototypes in Figma

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code : HUT1001 **Course : Foundational Literature of Indian Civilization L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits: 2**

Course outcome:

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

CO1: Understand the Indian knowledge system and its scientific approach

CO2: Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus

CO3: Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools

CO4: Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

Syllabus

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

***any one text as decided by the course teacher**

Reference material

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering

Course Code : PET1001 **Course : Sports-Yoga-Recreation**

L: 1 Hr, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 1**

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

Objectives of the Course:

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

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

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

Course Content: Unit1:- Theory: Introduction

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

Unit 2: - Practical- Exercises for Health and Wellness

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

Unit 3: - Yoga

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

References:

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering Course Code : PEP1001 Course : Sports-Yoga-Recreation Lab

L: 0 Hr, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 1

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

Objectives of the Course:

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

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

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

Course Content:

Unit1:- Theory: Introduction

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

Unit 2: - Practical- Exercises for Health and Wellness

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

- Physical Efficiency Tests

Unit 3: - Yoga

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

References:

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

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : PHT 2001 **Course : Introduction to Quantum Computing**

L: 2 Hrs, T: 1 Hr, P: 0 Hr, Per Week **Total Credits: 3**

Course Objectives

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

Course Outcomes

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

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

Module 1: Basic Quantum Theory

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

Module 2: Complex Vector Spaces

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

Module 3: Linear Algebra in Quantum Computing

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

Module 4: Classical and Quantum Systems

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

Module 5: Quantum representation of systems

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

Module 6: Architecture and Algorithms

Bits and Qubits, Classical Gates and their equivalent quantum representation, Reversible Gates: CNOT, Toffoli, Fredkin, gates, outline of Pauli X, Y, Z gates, Hadamard gates, Deutsch Gate.
Quantum Algorithms: Deutsch's algorithm, Grover's search algorithm.
Applications of quantum computing in Cryptography, Quantum teleportation, Cybersecurity, banking, finance, advance manufacturing and artificial intelligence.

Text Book

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

Reference Books

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

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : PHP 2001 **Course : Introduction to Quantum Computing Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 1**

Course Outcomes:

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

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

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

List of Experiments:

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

Reference Books

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

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : MAT 2002 **Course : Discrete Mathematics**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 3**

Course Objective:

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

Course Outcomes

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

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

Syllabus

Module 1: (9 Lectures)

Combinatorics: Addition and multiplication rule in combinatorics, Linear and

Circular permutation, Combination, Binomial Identities, Inclusion and Exclusion Principle, distribution Principle, recurrence relations, generating function, examples using ordinary power series and exponential generating functions.

Module 2: (8 Lectures)

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

Module 3: (7 Lectures)

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

Module 4: (9 Lectures)

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

Module 5: (7 Lectures)

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

Text Books:

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

Reference Books:

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

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : MAP 2001 **Course : Computational Mathematics Lab**

L:0 Hr, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 1**

Course Objectives:

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

Proposed Course Outcomes:

By using open source software SageMath Students will be able to

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

CO2: Sketch and analyze function graphs.

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

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

CO5: Understand and Analysis Data inscription standards.

CO6: Analyze the data to find best fit curve.

Mapping of Course outcomes (COs) withExperiments

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

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : CHT2007 **Course : Bioinformatics**

L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 2**

Course Outcomes:

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

CO1: Explain the functioning of various metabolic processes in the human body. CO2: Acknowledge the importance of metabolic simulations in drug discovery,

CO3: Explain the functioning of various types of the drugs for therapeutic applications. CO4: Use knowledge of bioinformatics for basic formulation of drug design

Unit- I Introduction to Biomolecules Carbohydrates: Introduction and classification Amino Acid: Chemistry properties and metabolism.

Proteins: primary, Secondary, tertiary and quaternary structure,

Lipids: Chemistry, Metabolism of fatty acids, Phospholipids, Cholesterol regulation of metabolism. Nucleic Acid: Chemistry of DNA and RNA,

Vitamins: Structure and functions of some vitamins.

Unit-II Introduction to bioinformatics:

Introduction, Biological data: Sequence, gene expression, pathways and molecular interaction: Data bases: Sequence, Gene bank, Dogmass- central and peripheral, The standard genetic code, applications.

Unit -III Drug and Data Bases

Drug and Data bases: Introduction, classification of drugs, Drug Solubility/permeability, Drug Likeness Introduction to metabolic engineering and systems biology, role of metabolic simulations in drug discovery,

Unit-IV Computer Aided Drug Design

Introduction to molecular docking, rigid docking, flexible docking, 3D pharmacophore, 3D data base searching and virtual searching, pharmacophore modelling, brief introduction about various online tools for drug designing and molecular docking.

Text Books

1. Upadhayay, K. Upadhayay, N. Nath, Biophysical Chemistry (Principles and Techniques), Himalaya Publishing House, 2009.

2. David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry, Fifth Edition, W. H. Freeman and Company, New York, 2008.

3. Young David. Computational drug design: A Guide for Computational and Medicinal Chemists. Publisher: Wiley. 2009. ISBN: 9780470126851

Reference books:

1. Bioinformatics: Sequence and Genome Analysis, Mount. D. W, CSHL Press, New York 2nd

Edition 2004.

2. Introduction to Bioinformatics by Arthur M. Lesk University of Cambridge, Published in the United States by Oxford University Press Inc., New York

3. Introduction to Computational Biology: Maps, Sequences and Genomes, Waterman, M., Chapman and Hall, 1995.

4. Abraham, Donald (Ed). Burger's medicinal chemistry and drug discovery. Publisher: John Wiley & Sons, Inc. 2003. ISBN: 0471270903

5. Schlick, T. Molecular modelling and simulation: an interdisciplinary guide. Publisher: Springer. 2002. ISBN: 0-387-95404-X

6. Leach, Andrew. Molecular Modelling: Principles and Applications. Publisher: Prentice Hall. 2001. ISBN: 0582239338.

7. Jensen, Jan H. Molecular Modeling Basics. Publisher: CRC Press. 2010. ISBN: 978-1420075267

8. Hinchliffe Alan. Molecular modelling for beginners. Publisher: John Wiley and Sons Ltd. 2008. ISBN: 978 0470513149

E- Text book

1. Computer Aided Drug Design by Prof. Mukesh Doble, Biotechnology, IIT, Madras(Swayam NPTEL)

Syllabus for Semester II, B. Tech. Computer Science & Engineering Course

Code: CST2001 **Course: Object Oriented Programming**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To make students understand Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
2. Introduce students with fundamental concepts like exception handling, generics, collection classes and streams.

Syllabus

Unit I:

Features of Object-Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding. Programming paradigms, Bytecode, JDK, JRE, JVM.
Concept of a class and object, ways of representing objects, access control of members of a class, instantiating a class, constructor.

Unit II:

Concept of overloading: Constructor Overloading, Function Overloading.
Arrays and Array of objects, Wrapper classes (Integer, Double etc.), String Class, creating packages, importing packages.
Lambda Expressions Introduction, Block, Passing Lambda expression as Argument

Unit III:

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, static and non-static members.

Unit IV:

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, Introduction to streams, byte streams, character streams, file handling in Java, Serialization.

Unit V:

Generics, generic class with two type parameter, bounded generics.
Collection classes: Arraylist, LinkedList, TreeSet, HashMap, Iterator, ListIterator, Comparator, Comparable

Unit VI:

Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioral Patterns.

Course Outcomes:

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

1. Understand the object-oriented programming features, classes, objects and methods.
2. Develop efficient programs by implementing the concept of Inheritance, polymorphism exception handling.
3. Use the concept of generics, collections, streams to develop solution to the given problem.
4. Analyze characteristics and need of design pattern in software design process.

Text Books

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. Design Patterns By Erich Gamma, Pearson Education

Reference Books

1. Paul Deitel, Harvey Deitel; Java 9 for Programmers; Pearson
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw- Hill Education Private Ltd 2013.

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code : CSP2001 **Course : Object Oriented Programming Lab**

L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits : 1**

Course Objectives

1. To develop ability of students to implement basic concepts and techniques of object oriented programming paradigm like encapsulation, inheritance, polymorphism, exception handling.
2. Develop solution to problems using collection classes, generics, streams, multithreading.

Course Outcomes

On completion of the course the student will be able to

1. Develop the solutions using basic features of Object Oriented Programming.
2. Design efficient and reusable solutions using inheritance and exception handling techniques.
3. Create and use type-safe object through generics and collection classes

SYLLABUS

Experiments based on above Syllabus.

Syllabus for Semester II, B. Tech. Computer Science & Engineering

Course Code: CST2002 **Course: Computer Architecture**

L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 2**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. Concepts of computer architecture by developing understanding of various functional units, components of computers and working of all the modules.
2. Design principles of modern computers including memory, bus system, input/output operation, interrupt handling mechanism and parallelization.

SYLLABUS

UNIT I : Basic Structure of Computers: Functional units of computer, basic operational concepts- Instruction, processor and memory, operating steps, address, Big- and Little-endian assignments, Instructions set architecture of a CPU- Instruction Formats, Instruction sequencing, addressing modes, and instruction set classification, subroutine & parameter passing, expanding opcode, RISC and CISC.

UNIT II : Basic Processing Unit and Data Representation: Basic Concepts- Instruction execution, Bus architecture- One bus and Multi-bus, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro-programmed Control. Floating point numbers-representation, guard bits and rounding.

UNIT III : Memory & Input/output: Cache memory, Cache size vs. block size, mapping functions, replacement algorithms, Cache read/write policy, Virtual Memory, I/O mapped I/O and memories mapped I/O, interrupt and interrupt handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Bus Arbitration, Direct Memory Access

UNIT IV : Pipelining: Basic concepts of pipelining, throughput and speedup, Introduction of Parallel Computing: SISD, MISD, SIMD, MIMD

Course Outcomes:

On Successful completion of course, students will be able to:

1. Demonstrate the understanding about the functional units of a digital computer system.
2. Execute complete instruction on different types of bus architectures with control signal generation.
3. Analyse memory, multiprocessor and multicore architectures and their implications in parallel computing.

Text Books

1. V.C.Hamacher, Z.G.Vranesic and S.G.Zaky; Computer Organisation; 5th edition; Tata McGraw Hill, 2002.
2. W. Stallings; Computer Organization & Architecture; PHI publication; 2001.
3. J. P. Hayes; Computer Architecture & Organization; 3rd edition; McGraw-Hill; 1998.
4. Reference Books
5. M Mano; Computer System and Architecture; PHI publication; 1993.
6. A.S.Tanenbaum; Structured Computer Organization; Prentice Hall of India Ltd.

Syllabus for Semester II, B. TECH Computer Science & Engineering

Course Code : CST2003 **Course : Computer Workshop-II**

L: 1Hrs, T: 0 Hr, P: 0 Hr, Per **Total Credits: 1**

Course Objective

The objective of this course is to familiarize the students with an important web framework for developing user interfaces. It aims for developing high end web applications by the use of ReactJS features.

Course Contents

UNIT-I

Introduction to React

React JS Introduction, Advantages of React JS, Introduction to JSX, Difference between JS and JSX.

UNIT-II

Components in React

React Components overview, Types of components, Controlled, Split Up, Composable, Reusable, Component Declarations and Styling Components

State and it significance, Read state and set state, Passing data to component using props, Validating props using prop Types, Supplying default values to props using default Props

UNIT-III

Routing with react router

Introduction to React Router, Routing in single page applications, Browser Router and Hash Router components Configuring route with Route component.

Course Outcomes

After successful completion of this course, the student will be able to,

1. Implement the fundamentals of React with Java Script and JSX
2. Understand Templating concept along with different types of components, props and state in ReactJS
3. Implement Router with React Router.

Text Books

- Pure React- a step by step guide - Dave Ceddia
- Road to learn react - Robin Wieruch
- React in Action 1st Edition - Mark Tielens Thomas

Syllabus for Semester II, B. TECH Computer Science & Engineering

Course Code : CSP2003 **Course : Computer Workshop-II Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits: 1**

Course Objective

The objective of this course is to familiarize the students with an important web framework for developing user interfaces. It aims for developing high end web applications by the use of ReactJS features.

Syllabus:

Practical based on Theory Syllabus

Course Outcomes

After successful completion of this course, the student will be able to

1. Understanding the fundamentals of ReactJS including components, props, state.
2. Design and implement complex applications by composing smaller, reusable components together.
3. Building Web Applications to create dynamic and interactive web applications using React and other related technologies like JSX and ES6.
4. Implement React Router to handle client-side routing and create single-page applications.

Syllabus for Semester II, B. TECH Computer Science & Engineering

Course Code : HUT2002 **Course: English for Professional Communication**

L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 2**

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Course Objectives

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

Course outcomes:

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

CO1. Demonstrate effective use of word power in written as well as oral communication.
CO2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.
CO3. Apply the principles of functional grammar in everyday as well as professional communication.
CO4. Effectively implement the comprehensive principles of written communication by applying various writing styles.
CO5. Create precise and accurate written communication products.

Unit-1: Vocabulary Building

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

Unit -2: Listening and Reading Comprehension

2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening

2.2 Reading Comprehension: types and strategies.

Unit -3: Functional Grammar and Usage

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

Unit-4: Writing Skills

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

Unit-5: Writing Practices

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

Books

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

Syllabus for Semester II, B. TECH Computer Science & Engineering

Course Code : HUP2002 **Course: English for Professional Communication Lab L: 0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week** **Total Credits: 1**

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Course Objective

To enhance competency of communication in English among learners

Course Outcomes

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

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

CO2: Demonstrate the techniques of effective Presentation Skills

CO3: Evaluate and apply the effective strategies for Group Discussions

CO4: Analyse and apply the effective strategies for Personal Interviews

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

Syllabus

List of practicals

Computer Assisted + Activity Based Language Learning

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

Practical 2: Pronunciation, Intonation, Stress, and Rhythm

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

Activity Based Language Learning

Practical 4: Presentation Skills: Orientation & Mock Session

Practical 5: Presentation Skills: Practice

Practical 6: Group Discussions: Orientation & Mock Session

Practical 7: Group Discussions: Practice

Practical 8: Personal Interviews: Orientation & Mock Session

Practical 9: Personal Interviews: Practice

Syllabus for Semester II, B. TECH Computer Science & Engineering

Course Code : HUP2003 **Course: Liberal/Performing Art**

L: 0 Hr, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 1**

Scheme and syllabus

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

Course objective

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

Course Outcomes

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

CO1: Understand the importance of dance and Bharatnataym as an Indian dance form CO2:
Develop skills to perform the dance form at its basic level.

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

Syllabus

Practical -1: Orientation in Bharatnatayam

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

Practical -3: Practice sessions

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

Practical-5: Practice sessions

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

Practical-7: practice sessions

Practical – 8: final practice sessions and performances.

Recommended reading

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

Scheme and syllabus

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Ma (Continuous Eval
HUP0001-2	Fundamentals of Indian Classical Dance: Kathak	I/II	2	1	50

Course objective

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

Course Outcomes

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

CO1: Understand the importance of dance and Kathak as an Indian dance form CO2:
Develop skills to perform the dance form at its basic level.
CO3: Evaluate their strengths and interest to take bridge course to give *Prarambhik* (1st level formal exam of Kathak).

Syllabus

Practical -1: Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 count (Bhramari),
Practical -2: practice sessions of practical 1
Practical -3: Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings
Practical -4: practice sessions of practical 3
Practical -5: Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,
Practical -6: practice sessions of practical 5
Practical -7: 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions
Practical -8: Final performances.

Recommended reading

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

Scheme and syllabus

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

Course objective

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

Course outcome:

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

CO1: Develop an understanding of the technical aspects and aesthetics of Photography. CO2: Apply the rules of digital photography for creating photographs.
CO3: Develop skills to enhance photographs through post processing.
CO4: Create a portfolio of their photographs in selected genre.

Syllabus

Practical 1: **Orientation in digital photography:** Genres, camera handling and settings
Practical 2: **Rules of Composition**
Practical 3: **Rules of Composition**: practice sessions
Practical 4: **Understanding Exposure and Art of Pre-Visualization**
Practical 5: **Rules of Composition and Art of Pre-Visualization:** practice sessions
Practical 6: **Post Processing Photographs and Portfolio creation**
Practical 7: **Post Processing Photographs:** practice sessions
Practical 8: **Portfolio finalization and presentation in selected genre.**

Reference material

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

Scheme and syllabus

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

Course objective

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

Course outcome

CO1: Gain a brief understanding about Japan as a country and Japanese culture.
CO2: Develop ability to use vocabulary required for basic level communication in Japanese language. CO3: Able to write and read the first script in Japanese language.
CO4: Able to frame simple sentences in Japanese in order to handle everyday conversations CO5: Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical-1: Orientation about Japan, its language, and its culture
Practical-2: Communication Skills 1: Vocabulary for basic Japanese language
Practical -3: Practice sessions
Practical-4: Writing Skills 1: Reading and writing first script in Japanese
Practical-5: Practice sessions
Practical- 6: Communication Skills 2: framing sentences
Practical- 7: Practice sessions
Practical- 8: Writing Skills 2: Write basic Japanese and practice

Recommended reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Scheme and syllabus

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

Course objectives:

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

Course Outcomes:

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

CO1: Understand and synthesize the working of the prominent genres of theatre across the world. CO2: Apply the skill of voice and speech in theatre and public speaking

CO3: Apply the art of acting and also develop generic skills such as confidence, communication skills, self-responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.

CO4: Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus:

Syllabus

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

Reference books:

1. Boleslavsky, R. (2022). *Acting: The First Six Lessons* (1st ed., pp. 1-92). Delhi Open Books.

2. Shakthi, C. (2017). *No Drama Just Theatre* (1st ed., pp. 1-171). Partridge.

3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., & Zigler, S. (1986). *A Practical Handbook for the Actor* (1st ed.). Vinatge Books New York.

Scheme and syllabus

Course Code	Course Name	Sem.	Hours/week	Credits	Maximum Marks (Continuous Evaluation)
HUP0001-6	Introduction to French Language	I/II	2	1	50

Course objective:

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

Course outcomes:

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

CO1. Demonstrate basic knowledge about France, the culture and similarities/differences between India and France
CO2. Learn to use simple language structures in everyday communication. CO3.
Develop ability to write in basic French about themselves and others. CO4.
Develop ability to understand beginner level texts in French

Syllabus

List of Practicals

Practical-1: Orientation about France, the language, and culture
Practical-2: Communication Skills 1: Vocabulary building for everyday conversations
Practical -3: Practice sessions
Practical-4: Reading and writing Skills : Reading and writing simple text in French
Practical-5: Practice sessions
Practical-6: Communication Skills 2: listening comprehension
Practical-7: Practice sessions
Practical-8: Writing Skills: Write basic French and practice

Recommended reading

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

Scheme and syllabus

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

Course objective:

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

Course outcomes:

On successful completion of the course the students will be able to achieve the following:
CO1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France
CO2. Learn to use simple language structures in everyday communication. CO3.
Develop ability to write in basic Spanish about themselves and others. CO4.
Develop ability to read and understand beginner level texts in Spanish

Syllabus

List of Practicals

Practical-1: Orientation about Spain, the language, and culture
Practical-2: Communication Skills 1: Vocabulary building for everyday conversations
Practical -3: Practice sessions
Practical-4: Reading and writing Skills : Reading and writing simple text in Spanish
Practical-5: Practice sessions
Practical-6: Communication Skills 2: listening comprehension
Practical-7: Practice sessions
Practical-8: Writing Skills: Write basic Spanish and practice

Recommended reading

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

Scheme and syllabus

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

Course objective

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

Course outcome:

At the end of the course the students will be able to achieve the following: CO1: Become familiar with the basic methods, techniques & tools of painting. CO2: Train the eye and hand to develop sense of balance, proportion and rhythm. CO3: Develop the ability to observe and render simple natural forms.
CO4: Enjoy the challenging and nuanced process of painting.

Syllabus

Practical 1: **Orientation in Painting tools & basics of lines, shapes, light, shadows and textures**
Practical 2: **The art of observation** how to see shapes in drawing
Practical 3: **Introduction Water color** how to handle water paints
Practical 4: **Introduction to acrylic colors** how to handle acrylic paints
Practical 5: **Explore layering paint and capturing the quality of light with paint.**
Practical 6: **Create landscape painting**
Practical 7: **Create Abstract painting**
Practical 8: **Paint on Canvas** (try to recreate any famous painting)

Reference material

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

Scheme and syllabus

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

Course objective

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

Course outcome:

At the end of the course the students will be able to achieve the following: CO1: Become familiar with the basic methods, techniques & tools of drawing. CO2: Train the eye and hand to develop sense of balance, proportion and rhythm. CO3: Develop the ability to observe and render simple natural forms.
CO4: Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical 1: **Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures**
Practical 2: **The art of observation** how to see shapes in drawing
Practical 3: **One/two-point basic linear perspective**
Practical 4: **Nature drawing and landscapes**
Practical 5: **Gestalt principles of visual composition**
Practical 6: **Figure drawing**: structure and proportions of human body
Practical 7: **Gesture drawing:** expression and compositions of human figures
Practical 8: **Memory drawing:** an exercise to combine the techniques learnt

Reference material

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

Scheme and syllabus

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

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

Course outcome:
After the completion of the course the students will be able to do the following:
CO1: Develop an affinity with nature by observing and understanding it marvels with guidance from experts
CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

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

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

Course Code : HUT2004 **Course: Foundation course in Universal Human Values L: 1 Hr, T: 0 Hr, P: 0 Hrs, Per Week** **Total Credits: 1**

Course Objectives:

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

Course outcome:

On completion of course, students will be able to achieve the following:
CO1: Develop a holistic perspective of life
CO2: Better understanding of inter-personal relationships and relationship with society and nature.
CO3: An ability to strengthen self-reflection

Syllabus

Unit 1:- Aspirations and concerns

Need for Value Education: Guidelines and content of value education.
Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being

Unit 2:- Health

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

Unit 3:- Relationships and Society

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

Reference Material

The primary resource material for teaching this course consists of

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

Reference books:

a) B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
b) PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
c) Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
d) Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
e) Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
f) Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
g) A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
h) E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
i) A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CST5002 **Course: Compiler Design**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

The main objective of this course is to introduce the fundamental concepts of compiler design and language translation. It aims to develop an understanding of the structure, function, and complexity of modern compilers. The students will learn the various phases of compilation with practical implementation using compiler writing tools.

Syllabus

UNIT I:
Introduction to Compilers, Phases of Compiler, Relating Compilation Phases with Formal Systems, Lexical Analysis, tokens, pattern and lexemes, Design of Lexical analyser, Regular Expression, transition diagram, recognition of tokens, Lexical Errors.

UNIT II:
Syntax Analysis- Specification of syntax of programming languages using CFG, Top-down parser, design of LL (1) parser, bottom-up parsing technique, LR parsing, Design of SLR, CLR, LALR parsers, Handling Ambiguous Grammars, Applications of the LR Parser.

UNIT III:
Syntax directed translation- Study of syntax directed definitions & syntax directed translation schemes, Type and Type Checking, Implementation of SDTS, Intermediate notations, translation of Assignment Statement, controls structures, Array reference.

UNIT IV:
Code optimization- machine independent Optimisation, Local optimization techniques, loop optimization- control flow analysis, data flow analysis, Loop invariant computation, Induction variable removal, other loop optimization techniques, Machine-dependent Optimization techniques.

Code generation- Problems in code generation, Simple code generator, code generation using labelling algorithm, code generation using gencode algorithm

UNIT V:
Storage allocation & Error Handling- Run time storage administration, stack allocation, Activation of Procedures, Storage Allocation Strategies, Garbage Collection, symbol table management,
Error handling, Error detection and recovery- lexical, syntactic and semantic, Error recovery in LL & LR Parser

Course Outcomes:

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

1. Exhibit role of various phases of compilation, with understanding of types of grammars and design complexity of compiler.
2. Design various types of parses and perform operations like string parsing and error handling.
3. Demonstrate syntax directed translation schemes, their implementation for different programming language constructs.
4. Implement different code optimization and code generation techniques using standard data structures.

Text Books

1. Aho, Sethi, and Ullman; Compilers Principles Techniques and Tools; Second Edition, Pearson education, 2008.
2. Alfred V. Ahoand Jeffery D. Ullman; Principles of Compiler Design; NarosaPub.House, 1977.
3. VinuV. Das; Compiler Design using Flex and Yacc; PHI Publication, 2008.
4. Manoj B Chandak, Khushboo P Khurana; Compiler Design; Universities Press, 2018.

Reference Books

1. Vinu V. Das; Compiler Design using Flex and Yacc; PHI Publication
2. V. Raghavan; Principles of Compiler Design, McGraw Hill Education (India)

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CSP5002 **Course: Compiler Design Lab**
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Objectives

This laboratory course is designed to provide students with hands-on experience in the fundamental techniques of compiler construction. Through a series of experiments and practical implementations, students will explore the core phases of a compiler. The course also introduces various compiler development tools which enables students to understand and build components of a working compiler.

Syllabus

Practicals based on syllabus of Complier Design.

Course Outcomes:

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

1. Use Open-Source tools to design lexical analyzer and parser.
2. Implement different types of Parsing techniques.
3. Implement various syntax directed translation schemes to generate intermediate code .
4. Implement various code optimization and code generation techniques.

Text Books

5. Doug Brown, John Levine, Tony Mason, Lex and Yacc, O'Reilly Media, 2nd Edition, 2012
6. Des Watson, A Practical Approach to Compiler Construction, Springer, 1st ed. edition, 2017

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CST5003 **Course: Artificial Intelligence**
L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 3**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. Introduction of problem-solving techniques, task domains and intelligent agent structures in AI.
2. Representation of given problem using state space representation and solve it by using different search techniques.
3. Understanding of adversarial search, game-playing strategies and constraint satisfaction problems
4. Understand of knowledge representation and uncertainty theory in designing AI systems.

Syllabus

UNIT I:

Introduction to Artificial Intelligence: History, applications, task domains, Basics of problem solving, problem characteristics, problem representation (toy problems and real-world problems); Structure of agent, rational agent, specifying task environment, Properties of task environment, measuring problem solving performance.

UNIT II:

Uninformed search techniques: Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS, Bidirectional Search.

UNIT III:

Informed search techniques: Heuristic Based Search, Greedy Best First Search, A* Search; Local Search algorithms: Hill-climbing, Genetic Algorithms.

UNIT IV:

Adversarial Search: Two player Games, The min-max algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems: Constraint propagation, backtracking search.

UNIT V:

Knowledge Representation and Uncertainty theory: Propositional logic, First Order Logic: Syntax and Semantics of FOL, Inference in FOL: Unification Algorithm, Resolution, Forward Chaining, Backward Chaining. Probability and Bayes' Theorem, Statistical reasoning: Bayesian networks, Bayes optimal classifier, Naïve bayes algorithm, Introduction to expert system.

Course Outcomes:

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

1. Explain the historical evolution, applications and problem-solving characteristics of AI.
2. Apply uninformed and informed search techniques and represent given problem using state space representation.
3. Utilize different AI techniques to solve fully informed two player games and constraint satisfaction problems.
4. Demonstrate knowledge representation techniques and Uncertainty theory in AI decision-making scenarios.

Text Books and Reference Books:

Text Books:

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Fourth Edition; Pearson Education, 2022.
2. E. Rich, K. Knight, S.B. Nair; Artificial Intelligence ,3rd Edition, Tata McGraw Hill, 2009.

Reference Books:

1. Dan W Patterson, Introduction to Artificial Intelligence & Expert System, Pearson Education India; First Edition, 2015.
2. By Patrick D. Smith, David Dindi, Hands-On Artificial Intelligence for Beginners: An introduction to AI concepts, algorithms, and their implementation, First edition, Packt Publishing Ltd, 2018.
3. Richard E. Neapolitan, Xia Jiang, Artificial Intelligence with an Introduction to Machine Learning, Chapman and Hall/CRC; 2nd edition, 2018.

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CSP5003 **Course: Artificial Intelligence Lab**
L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits: 1**

Course Outcomes:

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

1. Implement different AI toy problems by using search techniques.

2. Design two player games using min-max algorithm with Alpha-Beta pruning.

3. Simulate AI problems using logic programming.

4. Implement probabilistic based methods to solve classification problems.

PRACTICALS BASED ON ARTIFICIAL INTELLIGENCE SYLLABUS

Text Books and Reference Books:

Text Books:

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Fourth Edition; Pearson Education, 2022.

Reference Books:

1. By Patrick D. Smith, David Dindi, Hands-On Artificial Intelligence for Beginners: An introduction to AI concepts, algorithms, and their implementation, First edition, Packt Publishing Ltd, 2018.

2. Richard E. Neapolitan, Xia Jiang, Artificial Intelligence with an Introduction to Machine Learning, Chapman and Hall/CRC; 2nd edition, 2018.

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CST5004 **Course: Data Handling and Visualization**
L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 3**

Course Objectives

The course aims to familiarize the students with the process of exploring data, transforming data, and presenting it in a way that is meaningful to others.

UNIT - I:

Importance of data analytics and visualization, data preprocessing, Variables and Types of data, Data collection and sampling techniques, Understanding different data types and sources, Ethics, privacy, and responsible data handling

Unit II:

Measures of central tendency, measures of variation, measures of position, five-number summary, boxplots, correlation analysis.

Unit III:

Probability distributions, normal distributions, binomial distribution, other types of distributions, central limit theorem.

Unit - IV :

Understanding Data Visualization Principles, Mapping Data onto Aesthetics, Visualizing - Distributions, Proportions, Time Series, Trends and Uncertainty; Commonly used File Formats and Software.

UNIT - V : Creating Stories with Data

Why Planning?, Creating Interesting Stories with Data – Reader-driven Narratives, Author-driven Narratives; Perceptions and Presentation Methods, Best Practices in Visualization, Interactive Visualization, Event Listeners and Layouts, Case Studies for Visualization.

Course Outcomes:

1. Understand and apply different data preprocessing techniques.
2. Apply descriptive statistical techniques for data analysis.
3. Apply appropriate data visualization technique(s).
4. Create good data stories.

Text Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data – EMC Education Services, Wiley Publication
2. Claus O. Wilke, “Fundamentals of Data Visualization – A Primer on Making Informative and Compelling Figures”, O’Reilly, 2019.

Reference Books :

1. Kyran Dale, “Data Visualization with Python and JavaScript – Scrape, Clean and transform Your Data”, O’Reilly, 2016.
2. Data Analytics using Python – Bharati Motwani, Wiley Publications

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CSP5004 **Course: Data Handling and Visualization Lab**
L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits: 1**

Course Objectives

The course aims to familiarize the students with the process of exploring data, transforming data, and presenting it in a way that is meaningful to others.

Course Outcomes:

On completion of the course the student will be able to

1. Understand and apply different data preprocessing techniques.
2. Apply descriptive statistical techniques for data analysis.
3. Apply appropriate data visualization technique(s).
4. Create good data stories.

Syllabus : Based on above course.

Text Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data – EMC Education Services, Wiley Publication
2. Claus O. Wilke, “Fundamentals of Data Visualization – A Primer on Making Informative and Compelling Figures”, O’Reilly, 2019.

Reference Books :

1. Kyran Dale, “Data Visualization with Python and JavaScript – Scrape, Clean and transform Your Data”, O’Reilly, 2016.
2. Data Analytics using Python – Bharati Motwani, Wiley Publications

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CST5005 **Course: Program Elective-I: System Design**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To introduce reliable software systems.
2. To understand the complex architectures, designing for performance and scalability, and implementing robust solutions.
3. Illustrate the benefits and drive the adoption of solutions for industry-based real-world problems.

Syllabus

UNIT I:
Introduction to System Design, System Design fundamentals, System Design Life Cycle, components of System Design, Trade-offs in system design, scalability vs. performance, availability vs. consistency, CAP theorem.

UNIT II:
Scalability techniques, vertical scaling, horizontal scaling, load balancing strategies, database replication. System design patterns.

UNIT III:
Databases in Designing Systems: Relational databases, non-relational databases, How to choose a database, Database sharding and partitioning, Database indexing.

UNIT IV:
Distributed system basics: Distributed system fundamentals, Distributed system

UNIT V:
High level Design (HLD) + LLD (Low Level Design), Event management, message passing, log file , Scalable web applications, DNS and load balancing, N-tier applications, HTTP and REST, Stream processing, Caching, Machine learning and System Design, Containerization and System Design, The cloud and System Design

Course Outcomes:

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

1. Understand system design essentials and different concepts of scalability.
2. Perform exceptional scenario building using appropriate databases and Distributed system fundamentals.
3. Ability to Perform High level Low Level Design.
4. Ability to do Event management, message passing and load balancing.

Text Books

1. System Design Interview Volume 1 and 2 by Alex Xu.

2. Designing Data-Intensive Applications, Martin Kleppmann.

3. Patterns of Enterprise Application Architecture 1st Edition by Martin Fowler.

Reference Books

1. Clean Architecture: A Craftsman’s Guide to Software Structure and Design, Robert C. Martin , Pearson.

2. Systems Analysis and Design, Scott Tilley, Cengage Learning.

3. System Analysis and Design, Alan Dennis, Barbara Wixom, Roberta M. Roth, Wiley.

Syllabus for Semester V, B. Tech. Computer Science & Engineering

Course Code: CST5005 **Course: Program Elective-I: Network Security**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To build strong fundamentals of cryptographic techniques and algorithms to realize Security Goals.
2. Understand authentication, access control, intrusion detection, and prevention.
3. Identify and mitigate software security vulnerabilities in existing systems.

Syllabus

UNIT I:

Introduction to Security

Security Goals, Different Types of Attacks on Networks, Threats, Vulnerabilities, Attacks, Data Integrity, Confidentiality, Anonymity Message and Entity Authentication Authorization, Non-repudiation, Classical Cryptographic Techniques.

UNIT II:

Symmetry key Cryptography

Algebraic Structures, Symmetric Key Cryptography: DES, Block Cipher Modes of operation, Advanced Encryption Standard. Key distribution, Attacks.

UNIT III:

Public key Cryptography

Mathematical background, Number Theory. Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem. RSA Algorithm, , Elliptic Curve Cryptography.

UNIT IV:

Message Authentication, Integrity and Key Management

Cryptographic Hash functions, Authentication, Message Authentication Code (MAC), Digital Signatures, DSA Signatures, Key Management, Diffie- Hellman Key Exchange Kerberos, X.509

UNIT V:

Network Security Practices and Wireless Security

Electronic Mail Security – PGP, – IP security – Web Security – The Secure Sockets Layer (SSL),Security in Wireless Local Area Networks, Security in Wireless Ad Hoc and Sensor Networks, Security of the Internet of Things.

Course Outcomes:

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

1. Analyse the Network Security Threats.
2. Apply cryptographic techniques and algorithms to build security-related applications.
3. Solve problems related to key generation and key exchange algorithms.
4. Implement necessary Security mechanisms to secure the Computer Network.
5. Understand the security concepts in Wireless network

Text Books

1. William Stallings; Cryptography & Networks Security Principles and Practice; 6th Edition
2. Pearson Education, 2013.
3. Atul Kahate; Cryptography and Network Security; 1st Edition; Tata McGraw Hill, 2008.
4. Behrouz A. Forouzan, Cryptography and network security MC Graw Hill 3rd Edition
5. C. Kaufman, R. Perlman, M. Speciner, “Network Security: Private Communication in a Public World”, Pearson Education, 2nd edition, 2002.

Reference Books

1. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
2. J. Edney, W.A. Arbaugh, “Real 802.11 Security: Wi-Fi Protected Access and 802.11i”, Pearson Education, 2004.
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6001 **Course: Machine Learning**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To introduce the basic concepts and techniques of machine learning.

2. To understand major machine learning algorithms.

3. To identify machine learning techniques suitable for a given problem.

Syllabus

UNIT I:

Concept Learning: The concept learning task, General-to-specific ordering of hypotheses, Version spaces, Inductive bias, Decision Tree Learning, Rule Learning: Propositional and First-Order, Over-fitting, Cross Validation, Experimental Evaluation of Learning Algorithms.

UNIT II:

Instance-Based Learning: K-Nearest neighbor algorithm, Radial basis functions, Case- based learning. Computational Learning Theory: probably approximately correct (PAC) learning, Sample complexity, Computational complexity of training, Vapnik Chervonenkis dimension.

UNIT III:

Artificial Neural Networks: Linear threshold units, Perceptron, Multilayer networks and backpropagation, recurrent networks.

UNIT IV:

Probabilistic Machine Learning: Maximum Likelihood Estimation, MAP, Bayes Classifiers Naïve Bayes, Bayes optimal classifiers, Minimum description length principle.

Bayesian Networks, Inference in Bayesian Networks.

UNIT V:

Expectation Maximization algorithm, preventing over fitting, Gaussian Mixture Models, K- means and Hierarchical Clustering.

Hidden Markov Models, Reinforcement Learning, Support Vector Machines, Ensemble learning: boosting, bagging.

Course Outcomes:

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

1. Solve the problems related to the fundamental concepts in machine learning.
2. Apply machine learning algorithms to solve classification, regression and clustering problems.
3. Analyse the strengths and weaknesses of various machine learning approaches.
4. Apply various machine learning models to efficiently solve real-world problems.

Text Books

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan Kaufmann, 1986.

2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, Morgan Kaufmann, 2003.

2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988.

3. Ethem Alpaydin, Introduction to Machine Learning, PHI.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6001 **Course: Machine Learning Lab**
L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits: 1**

Course Objectives

1. To implement basic machine learning algorithm for solving problem.

2. To understand the usage of datasets in implementing machine learning problems.

3. To learn various modern tools, packages and techniques for machine learning.

Syllabus Technology: Python.

- To implement Find-S algorithm to find maximally specific hypothesis on given dataset.
- To implement Candidate Elimination algorithm on Enjoy Sports dataset and find candidate hypothesis.
- To implement linear regression algorithm on given dataset.
- To implement decision tree classifier on given dataset and display generated tree.
- To Implement KNN algorithm for classification and regression on given datasets.
- To implement the perceptron algorithm for AND, OR and NOR Boolean functions.
- To implement the backpropagation algorithm for machine learning using suitable dataset.
- To implement the Naïve Bayes algorithm on given dataset.
- To implement the support vector machine algorithm on given dataset.

Course Outcomes:

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

1. Implement fundamental concepts used in machine learning algorithms.

2. Implement python programs for various learning algorithms.

3. Apply appropriate machine learning algorithms to various data sets.

4. Apply machine learning algorithms to solve real world problems.

Text Books

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan Kaufmann, 1986.

2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, Morgan Kaufmann, 2003.

2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988

3. Ethem Alpaydin, Introduction to Machine Learning, PHI

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6002 **Course: Computer Network**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To Introduce the fundamental concepts of each layer in the OSI and TCP/IP models.
2. To implement, and troubleshoot network topologies and examine network and transport Layer protocol working.
3. To learn about network security, firewalls, and intrusion detection.
4. To Investigate modern applications and technologies used in computer networks.

Syllabus

UNIT I:

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Data Link Layer: Error Detection and Error Correction - Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ. IEEE 802.3.

UNIT II:

Network Layer: Internet Protocol (IP) – Logical Addressing: IPV4, IP addressing and subnetting, IPV6, ARP, RARP, BOOTP and DHCP–Delivery, Routing protocols.

UNIT III:

Transport Layer: Elements of Transport protocols: Addressing, Connection establishment, Connection release, User Datagram Protocol (UDP), Transmission Control Protocol (TCP). TCP congestion control. Traffic shaping Leaky Bucket and token bucket. Algorithm.

UNIT IV:

Application Layer: Domain Name Space (DNS), File Transfer Protocol (FTP), WWW, HTTP, Network security principles and threats, Cryptographic techniques (symmetric/asymmetric encryption), SSL/TLS protocols.

UNIT V:

Firewalls, VPNs, and IPS/IDS (Intrusion Detection and Prevention Systems), SDN network: architecture, controller, OpenFlow protocol and SDN communication models.

Course Outcomes:

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

1. Implement the computer network protocols with topologies.
2. Apply error detection and correction mechanisms related to data Link Layer and implement Routing algorithm.
3. Analyze TCP protocol related to traffic shaping and routing algorithms.
4. Implement network security mechanisms to protect data and infrastructure.
5. Simulate SDN network for dynamic network control and management.

Text Books

1. "Computer Networks" by Andrew S. Tanenbaum, David J. Wetherall (5th Edition), Pearson Education
2. "Data and Computer Communications" by William Stallings (10th Edition), Pearson Education
3. Data Communication and networking by Behrouz Forouzan (4th Edition) Mc Graw Hill Publication.
4. Cryptography And Network Security by Behrouz Forouzan (3rd Edition) Mc Graw Hill Publication.

Reference Books

1. "Computer Networking: A Top-Down Approach" by James F. Kurose, Keith W. Ross (7th Edition), Pearson Education.
2. "Network Security Essentials" by William Stallings (5th Edition), Pearson Education.
3. "Software-Defined Networking: Design and Deployment" by Patricia A. Morreale, Daniele Ceccarelli, Wiley.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6002 **Course: Computer Network Lab**
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Objectives

1. To understand and implement various networking concepts through hands-on experiments.
2. To provide practical knowledge of IP addressing, routing, switching, and network security.
3. To get hands-on with network simulation tools like Cisco Packet Tracer, GNS3, and Wireshark.
4. To explore common networking protocols and configurations for different network topologies.

Experiments may include, but are not limited to the following:

1. Network Troubleshooting and Diagnostic using Tools
2. Setup and usage of network simulation tools like Cisco Packet Tracer, GNS3, and Wireshark.
3. Configuring static IP addresses and subnet masks on devices and testing them on network
4. Data link Layer simulation
5. Configuring Dynamic Routing Protocols
6. Implementing port forwarding for specific applications
7. Analyzing various protocols (ARP, TCP, UDP, HTTP, etc.) using Wireshark
8. Automating device monitoring and configuration tasks.
9. Application Server configuration on simulation Tools

Text Books

1. "Computer Networks" by Andrew S. Tanenbaum, David J. Wetherall (5th Edition), Pearson Education
2. "Data and Computer Communications" by William Stallings (10th Edition), Pearson Education
3. TCP/IP protocol suite by Behrouz Forouzan (4th Edition) Mic Graw Hill Publication.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6003 **Course: Design Pattern**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To learn the fundamentals of software design by referring a catalog of design patterns
2. Demonstrate how to use design patterns to address code development issues.
3. Identify the most suitable design pattern to address a given application design problem.
4. Apply design principles (e.g., open-closed, dependency inversion, substitution, etc).
5. Critique code by identifying and refactoring anti-patterns.

Syllabus

UNIT I:

Elements of Design Pattern, Describing Design Pattern, Design Pattern Classification, Role of design patterns in software design, Selection and usage of Design Patterns, Example implementation of design pattern using UML, Case Study: Designing a Document Editor.

UNIT II:

Creational Patterns: Introduction, Role of Creational patterns, Creational Pattern types: Factory method, Abstract Factory, Builder, Prototype, Singleton, Comparative study of creational patterns, and examples based on real life applications.

UNIT III:

Structural Design Patterns: Introduction, Role of Structural patterns, Encapsulating complex structures to simplify interactions between components, Decoupling Components, Structural Pattern types: Adapter, Bridge, Composite, Decorator, Façade, Proxy, Comparative study of structural patterns, and examples based on real life applications.

UNIT IV:

Behavioral Patterns-I: Introduction, Role of Behavioral pattern, Encapsulation of Behavior, Behavioral Pattern types: Chain of Responsibility, Template Method, State, Strategy, and Iterator.

UNIT V:

Behavioral Patterns-II: Effect of single object on set of objects, Analysis of mutual behavior of classes and object's state, Reference control between objects, Behavioral Pattern types: Observer, Mediator, Memento, Interpreter, Comparative study of Behavioral patterns, and examples based on real life applications.

Course Outcomes:

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

1. Analyze the need and ability of design patterns in the software design process.
2. Implement various solutions for creation of objects, their structure and the interaction between objects.
3. Develop a loosely coupled application using design patterns.
4. Analyze the tradeoffs of applying a design pattern to a given problem.

Text Books:

1. Design Patterns: Elements of reusable object-oriented software by Gamma Erich, Helm Richard, Johnson Ralph, and Vlissides John, Pearson Education
2. Design Patterns Explained by Alan Shallowly and James Trott, Addison-Wesley

Reference Books:

1. Pattern's in JAVA Vol-I by Mark Grand, WileyDreamTech.
2. JAVA Enterprise Design Patterns Vol-III by Mark Grand, WileyDreamTech.
3. Head First Design Patterns by Eric Freeman, O'Reilly.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6004 **Course: Program Elective –II: Image Processing**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To introduce the students to digital image processing fundamentals.
2. To enable students to analyze spatial and frequency domain filtering.
3. To aid students in using image compression and prominent color spaces.
4. To facilitate use of image segmentation and feature extraction.

SYLLABUS

UNIT – I: Digital Image Fundamentals

Digital Image Processing – Introduction, Applications of Image Processing; Fundamental Steps in Digital Image Processing; Components of Digital Image Processing.

Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Basic Relationships Between Pixels – Neighborhood, Adjacency, Connectivity, Distance Measures and Mathematical Operations.

UNIT – II: Intensity Transformations and Special Filtering

Basic Intensity Transformation Functions; Histogram Processing; Fundamentals of Spatial Filtering; Spatial Correlation and Convolution; Smoothing Spatial Filters; Sharpening Spatial Filters; High-Pass, Band-Reject, and Band-Pass Filters; Combining Spatial Enhancement Methods.

UNIT – III: Filtering in the Frequency Domain

Preliminary Concepts; Sampling and the Fourier Transform of Sampled Functions; Discrete Fourier Transform of One Variable; Extensions to Functions of Two Variables; Some Properties of the 2-D DFT and IDFT;

Basics of Filtering in the Frequency Domain; Image Smoothing Using Low-Pass Frequency Domain; Filters; Image Sharpening Using High-Pass Filters; Selective Filtering; The Fast Fourier Transform.

UNIT – IV: Image Compression and Color Image Processing

Fundamentals; Huffman Coding; Golomb Coding; Arithmetic Coding; LZW Coding; Run-length Coding; Symbol-based Coding; Bit-plane Coding; Block Transform Coding; Predictive Coding; Wavelet Coding.

Color Fundamentals; Color Models; Pseudo-color Image Processing; Basics of Full-Color Image Processing; Color Transformations.

UNIT – V: Image Segmentation and Feature Extraction

Foundation; Point, Line, and Edge Detection; Thresholding; Segmentation by Region Growing and by Region Splitting and Merging; Region Segmentation Using Clustering and Superpixels; Segmentation Using Morphological Watersheds; The Use of Motion in Segmentation.

Boundary Preprocessing; Boundary Feature Descriptors; Region Feature Descriptors; Principal Components as Feature Descriptors; Whole-Image Features; Scale-Invariant Feature Transform (SIFT).

Course Outcomes:

On completion of the course the student will be able to

1. Review fundamental concepts in digital image processing.
2. Perform image enhancement in spatial domain and frequency domain.
3. Demonstrate different algorithms for image compression.
4. Apply image segmentation and feature extraction for object detection.

Text Books:

1. Rafael C. Gonzalez and Richard E, Woods; Digital Image Processing; Fourth Edition; Pearson Education; 2018.
2. S. Jayaraman, S. Esakkirajan and T. Veerakumar; Digital Image Processing; Tata McGraw Hill Education; 2009.

References:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle; Image Processing, Analysis, and Machine Vision; Third Edition; Cengage Learning; 2017.
2. Anil K. Jain; Fundamentals of Digital Image Processing; Second Edition; Prentice Hall of India; 2004.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6004 Course: Program Elective –II: Data Warehousing and Mining

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week Total Credits: 3

Course Pre-requisite

Database Management Systems

Course Objectives

1. Understand and implement techniques for preprocessing of classical data models and algorithms in data warehouses and data mining
2. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
3. Master data mining techniques in various applications like social, scientific and environmental context.

Syllabus

UNIT – I:

Introduction to Data Warehouse, Data Warehouse basic Concepts, Architecture of Data Warehouse, Overview of ETL and OLAP OLTP integration – comparison of OLAP with OLTP systems, ROLAP, MOLAP and HOLAP, Multidimensional modeling, Data Cube, Data Cube Computation methods, Advanced SQL support for OLAP

UNIT – II:

Data Cleaning methods, Descriptive Data Summarization, Data Reduction, Data Discretization, Data partitions, and Concept hierarchy generation Space Management in Data warehouse - Schemas for storing data in warehouse using different storage structures, B-tree index, hash index, clusters, Bitmap index functional index, domain index.

UNIT – III:

Introduction: - What is Data mining? Data Mining on what kind of data, Data mining Functionalities, Classification of Data Mining Systems, Major Issues on Data mining, KDD Process, Association Rule mining, Association Rule Generation, APRIORI Algorithm, The Partition Algorithms, FP-Growth Algorithms.

UNIT – IV:

Classification and Prediction: - Classification by decision tree induction, Bayesian Classification, Rule based Classification, Associative Classification, Classification by Back propagation, Support Vector Machines.

UNIT – V:

Clustering: Measuring Data Similarity and Dissimilarity Partition based Clustering, Hierarchical based

clustering, Density based clustering, Grid-Based Clustering.

Course Outcomes:

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

1. Use the fundamental theories and concepts of data warehousing in real life application.
2. Apply multi-dimensional modeling techniques in designing data warehouses and learn the process of data cleaning and pre-processing for mining applications.
3. Use the principles of data mining for designing data mining applications and Apply different methods and techniques involved in data mining.
4. Distinguish problems related to classification and clustering and evaluate accuracy of various classification and clustering algorithms.

Text Books

Jaiwei Han and Micheline Kamber; Data Mining Concepts and Techniques; 2 edition; Morgan Kaufmann Publishers, 2006.

Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

Reference Books

Tang and MacLennan, Data Mining with SQL Server 2005, Wiley Publishing, 2005

Data Warehousing and Fundamentals by Paulraj Ponniah, A Wiley-Interscience Publication

Margaret H Dunham, “Data Mining Introductory and advanced topics”, 6th Edition, Pearson Education, 2009.

Arun K Pujari, “Data Mining Techniques”,1st Edition, University Press, 2005.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6004 **Course: Program Elective –II: Robotic Process Automation**

L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Prerequisites

Basic knowledge of Artificial Intelligence and Machine Learning

Course Objectives

1. To introduce the fundamentals of Robotic Process Automation (RPA) and its applications.
2. To understand RPA techniques, tools, and platforms for automation.
3. To develop skills in designing, implementing, and deploying RPA solutions.

Syllabus

UNIT – I:

Introduction to Robotic Process Automation (RPA): Overview of RPA: Definition, Scope, and Benefits, Automation Techniques: What and How to Automate?, Components and Platforms of RPA, Introduction to UiPath: Installation and Setup, Recording and Playback: Task Recorder, Automating Gmail Trash & Recycle Bin

UNIT – II:

Workflow and Data Manipulation: Workflow Design: Sequences, Flowcharts, and Control Flow, Looping and Decision-Making Mechanisms, Data Manipulation: Variables, Scope, Collections, Arguments, Working with Data Tables, Clipboard Management, and File Operations, CSV/Excel Integration: Data Table Conversion

UNIT – III:

UI Interaction and Plugins: Identifying and Interacting with UI Controls, Techniques for Waiting and Acting on Controls, Screen Scraping and Optical Character Recognition (OCR), Integrating Plugins: SAP, Java, Citrix, Mail, PDF, Web, Excel, Word, Credential Management and Security Considerations

UNIT – IV:

Bot Development and Exception Handling: Assistant Bots and Event Monitoring, Exception Handling: Common Errors and Debugging Techniques, Logging and Crash Reporting, Debugging Strategies and Error Reporting

UNIT – V:

Deployment and Maintenance of RPA Bots: Project Organization and Workflow Reusability, Best Practices: Commenting, Config Files, State Machines, Publishing and Deploying Bots Using UiPath, Orchestration Server: Bot Management and Control, Monitoring and Maintaining Automated Processes

Course Outcomes:

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

1. Apply RPA concepts to automate various applications.
2. Analyze and choose suitable RPA techniques for different automation scenarios.
3. Design and implement automation workflows using UiPath.
4. Handle exceptions and optimize bot performance.
5. Deploy and maintain RPA solutions effectively.

Text Books

1. Alok Mani Tripathi, Learning Robotic Process Automation, 1st Edition, Packt Publishing, 2018.
2. Ed Freitas, Robotic Process Automation Succinctly, Succinctly EBook Series, 2020.

Reference Books

1. Robotic Process Automation, Nividous, 2018.
2. Vaibhav Srivastava, Getting Started with RPA using Automation Anywhere, BPB Publications, 2021.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6005 Course: Program Elective –III: Natural Language Processing
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week Total Credits: 3

Course Objectives

1. To familiarize the concepts and techniques of natural language processing.
2. To learn computational techniques that enable machines to process, understand, and generate human language efficiently.
3. To apply the statistical learning methods and cutting-edge research models to solve natural language processing problems.
4. To integrate natural language processing into real-world systems to develop, evaluate, and enhance applications.

Syllabus:

UNIT I:

Introduction to NLP, Definition and Scope, A Brief History, Importance, Challenges, Tasks, Significance, NLP Pipeline and Applications, Morphological Analysis and Generation using Finite State Automata, Finite State Transducer, Hidden Markov model, Viterbi Algorithm, Applications of Tagging.

UNIT II:

Lexical Analysis, Part-of-Speech (POS) Tagging, Approaches for POS Tagging, Rule-Based, Stochastic, Hybrid Approach, Taggers Evaluations, Tokenization with NLTK.

Syntax and Parsing, Types of Constituents in Sentences, Context-Free Grammar (CFG), CFG Parsing, Top-Down Parser, Bottom-Up Parser, Shallow Parsing and Chunking, Thematic Roles, Conditional Random Fields, Maximum Likelihood Estimation, Lexical and Probabilistic Parsing, Probabilistic Context Free Grammars, The Probability of a String, Inside-Outside Algorithm, CKY Parsing.

UNIT III:

Semantic Analysis, Lexical Vs Compositional Semantic Analysis, Word Senses and Relations, Types of Lexical Semantics, Word Sense Disambiguation, WordNet and Online Thesauri, Word Similarity and Thesaurus Methods, Text Representation, Word Embedding, TF-IDF, Bag of Words, Word2Vec, Skip-gram.

Pragmatic Analysis and Discourse, Discourse Phenomena, Coherence and Coreference, Importance of Coreference Relations, Discourse Segmentation, Algorithms for Coreference Resolution.

UNIT IV:

N-Gram Language Model, Language Modeling and Chain Rule, Markov Chain in N-Gram Model, Shannon's Method in N-Gram Model, Smoothing Techniques, Extrinsic Evaluation Scheme, Zero Counts Problems, Smoothing Techniques, Laplace (Add-One) Smoothing, Add-k Smoothing, Backoff and Interpolation Smoothing, Good Turing Smoothing, The Transformer, Large Language Models, Language Model Evaluation, Entropy, Perplexity, ROUGE, BLEU.

UNIT V:

Major NLP Applications, Information Retrieval Systems, Social Network Analysis, Sentiment Analysis, Information Extraction, Named Entity Recognition, Text Classification, Text Summarization Systems, Machine Translation, Word Alignment, Content Recommendation System, Answering Questions, Applications in Finance, E-Commerce, Travel and Hospitality, Marketing, Insurance, Healthcare, Law, Supply Chain, Telecommunication, Education and Research.

Course Outcomes

On Successful completion of course, students will be able to:

1. Understand core NLP concepts and techniques.
2. Apply various POS tagging approaches and parsing techniques to analyze sentence structure and utilize probabilistic models for syntactic analysis.
3. Analyze various semantic and pragmatic analysis techniques and discourse phenomena to enhance text representation and understanding.
4. Implement N-Gram language models and Transformer-based models for effective language modeling and text generation.
5. Design and develop innovative NLP solutions to address real-world challenges across industries like finance, healthcare, e-commerce, education and research.

Textbooks

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models, Third Edition, 2025, https://web.stanford.edu/~jurafsky/slp3.
2. Raymond ST. Lee, Natural Language Processing: A Textbook with Python Implementation, Springer Nature Singapore Pte Ltd. 2024, ISBN: 978-9819919987.
3. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana, Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems, O'Reilly Media, Inc., USA, First edition, 2020, ISBN: 978-1492054054.
4. Dipanjan Sarkar, Text Analytics with Python: A Practitioner's Guide to Natural Language Processing, Second Edition, Apress Media, LLC, California, 2019, ISBN: 978-1484243534.

Reference Books

1. Natural Language Processing with Python: From Basics to Advanced Projects, Second Edition, 2024, Cuantum Technologies LLC. Plano, ISBN: 979-8894968483.
2. Jyotika Singh, Natural Language Processing in the Real World: Text Processing, Analytics, and Classification, First edition, 2023, CRC Press is an imprint of Taylor & Francis Group, LLC, ISBN: 978-1003264774.
3. Gerhard Paaß and Sven Giesselbach, Foundation Models for Natural Language Processing: Pre-trained Language Models Integrating Media, Artificial Intelligence: Foundations, Theory, and Algorithms, Springer Nature Switzerland Pte Ltd. 2022, ISBN: 978-3031231896.
4. Lewis Tunstall, Leandro von Werra, and Thomas Wolf, Natural Language Processing with Transformers: Building Language Applications with Hugging Face, O'Reilly Media, Inc., USA, Revised First edition, May 2022, ISBN: 978-1098136796.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6005 Course: Program Elective –III: Natural Language Processing Lab
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week Total Credits: 1

Syllabus:

1. Experiments based on the above syllabus.
2. Few lab sessions shall be conducted using virtual lab platforms to enhance learning experiences and accessibility.
3. Utilise Hugging Face, Stanford, Kaggle, MIT OpenCourseWare, OpenAI Learning, Fast.ai, AllenNLP like repositories and platforms.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6005 **Course: Program Elective –III: Big Data Analytics**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives

1. To understand the basic concepts of big data analytics and the big data landscape.

2. To become proficient in the most popular big data computing frameworks in order to apply technology to solve various big data analytic problems.

Syllabus

UNIT - I

Introduction to Big Data: Big Data, its types, Challenges and characteristics, 3Vs, 6Vs definition Consistency Availability Partition Tolerance (CAP), Basically Available Soft State Eventual Consistency (BASE). Introduction to Big Data Platforms, Hadoop: Features, advantages, Hadoop1.0-Hadoop2.0, overview of Hadoop ecosystems. Map Reduce- Introduction, internal working, Map-reduce way of designing solutions with examples- Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

UNIT - II

Hadoop and System optimization for big data processing: Hadoop Eco System- Introduction to Hive, Pig, Big data storage- Hadoop Distributed File System, HBase Architecture, Improvements of map-reduce framework optimization for task scheduling and load balancing of map-reduce, job scheduling of Hadoop and its improvement, performance optimization of HDFS.

UNIT - III

Introduction to NoSQL databases, Cassandra: Architecture, Data Replication in Cassandra, Data model: cluster, keyspace, column family, Cassandra Keyspace Operations: Create, Alter, drop, Table Operations: create, alter, drop, truncate, index, CURD Operations, Cassandra CQL: data types, collections.

UNIT - IV

Hadoop Vs Spark, Big data computing framework: Spark – Introduction, Architecture, Spark's Language APIs, Spark concepts like Data Frames, Transformations, RDD, etc.; Spark toolset, Spark SQL, Spark streaming, programming in Spark.

UNIT - V

Machine Learning with Big Data and Link Analytics: Machine Learning with MLlib, classification and clustering with Big Data tool like Spark or Hadoop, Link Analysis - Page Rank, Modified page rank, Search Engine Optimization using page rank; Analyzing a Web Graph.

Course Outcomes:

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

1. Demonstrate the understanding of big data characteristics, challenges, and the technologies used to process and analyze large datasets.
2. Develop Big Data Solutions using big data frameworks such as Hadoop, and Spark.
3. Apply various functionalities of the NoSQL database and Machine Learning Techniques to extract insights from large data sets.
4. Perform web analytics and artificial intelligence on web-based systems to improve their performance.

Text Books

1. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.
2. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
3. Hien Luu; Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning Library, Apress, 2018
4. Leskovec, Rajaraman, Ullman, Mining of Massive Datasets, Cambridge University Press.

Reference Books

1. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
2. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
3. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman; Big Data for Dummies; Wiley India, 2015.
4. I.H. Witten and E. Frank, Data Mining: Practical Machine learning tools and techniques.
5. P. Simon, Too Big to Ignore: The Business Case for Big Data; Wiley, 2015.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6005 **Course: Program Elective –III: Big Data Analytics Lab**
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Objectives:

1. The lab course on big data analytics aims to provide hands-on experience with tools and techniques for managing and analyzing big data. It includes working with Hadoop, MapReduce, Spark, and Cassandra.

2. To apply various techniques to perform tasks related to web analytics.

Experiments based on syllabus of Big Data Analytics Theory.

Course Outcomes:

On Successful completion of this course, students will able to:

1. To implement web analytics using appropriate tools and techniques, by analyzing the data to extract insight from it.
2. Perform big data analytics on structured and unstructured data, using suitable technique and use of different tools.
3. To apply appropriate Machine Learning algorithms and big data techniques to address real-world problems.

References:

1. Tom White; Hadoop: The Definitive Guide, 4th Edition, O'Reilly, 2015.
2. Hien Luu; Beginning Apache Spark With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning Library, Apress, 2018.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014
4. H. Witten and E. Frank, Data Mining: Practical Machine learning tools and techniques.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6005 **Course: Program Elective –III: Basics of Ethical Hacking**
L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week **Total Credits: 3**

Course Objectives: by the end of this course, students will:

1. Understand ethical hacking concepts and its role in cybersecurity.
2. Learn various hacking techniques used by attackers.
3. Identify vulnerabilities in computer systems and networks.
4. Use basic penetration testing tools to analyze security threats.
5. Understand cyber laws and ethics related to hacking.

Syllabus

UNIT – I:

Introduction to Ethical Hacking: Definition and Scope of Ethical Hacking, Role of Ethical Hackers in Cybersecurity, Types of Hackers: White Hat, Black Hat, Grey Hat, Hacking Phases and Attack Lifecycle, Cyber Laws and Legal Aspects of Hacking.

UNIT – II:

Foot printing and Reconnaissance: Gathering Information about Target Systems, Passive vs. Active Reconnaissance, Open-Source Intelligence (OSINT), Google Dorking Techniques, Whois Lookup and Social Engineering

UNIT – III:

Scanning and Enumeration: Network Scanning Techniques, Identifying Open Ports and Services, Vulnerability Scanning Tools (Nmap, Nessus), OS Fingerprinting and Banner Grabbing. **System Hacking Basics:** Understanding Password Cracking, Brute Force and Dictionary Attacks, Keyloggers and Spyware, Privilege Escalation Techniques

UNIT IV:

Introduction to Penetration Testing: Basics of Penetration Testing, Phases of Penetration Testing (Planning, Scanning, Exploitation, Reporting), Penetration Testing vs. Vulnerability Assessment, Writing a Penetration Testing Report.

UNIT – V:

Cyber Laws & Ethical Responsibilities: Securing Web Applications, Overview of Cyber Laws, IT Act, GDPR, and Data Protection Laws, Ethical Responsibilities of an Ethical Hacker,

Course Outcomes:

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

1. Analyze the concepts and scope of ethical hacking.
2. Perform basic reconnaissance and scanning of networks.
3. Use hacking tools for password cracking and vulnerability assessment.
4. Apply ethical hacking techniques in a controlled environment to prevent common cyber threats.

Text Books

1. "The Web Application Hacker's Handbook" discovering and exploiting security flaws – Dafydd Stuttard & Marcus Pinto, Wiley Publication,2008.

2. Ethical hacking and penetration testing guide by Baloch, Rafay, CRC Press, 2015.

Reference Books

1. Stuart McClure, Joel Scambray and Goerge Kurtz, “Hacking Exposed Network Security Secrets & Solutions”, 5th Edition, Tata Mc Graw Hill Publishers, 2010.
2. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, “Gray Hat Hacking The Ethical Hackers Handbook”, 3rd Edition, McGraw-Hill Osborne Media paperback (January 27, 2011).

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6005 Course: Program Elective –III: Basics of Ethical Hacking Lab
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week Total Credits: 1

Course Objectives: Students will be able to

- Understand ethical hacking concepts and its role in cybersecurity.
- Learn various hacking techniques used by attackers.
- Identify vulnerabilities in computer systems and networks.

Course Outcomes:

Lab Exercises but not limited to

1. Using Nmap for Network Scanning
2. Performing WHOIS Lookups and OSINT Investigations
3. Exploiting Web Vulnerabilities using Burp Suite
4. Password Cracking using John the Ripper
5. Capturing Network Packets using Wireshark
6. Executing a SQL Injection Attack in a Safe Environment
7. Simulating a Phishing Attack for Social Engineering Awareness

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

1. Perform Examination on network scanning tool
2. Use hacking tools for password cracking and vulnerability assessment.
3. Simulate Phishing attack and SQL Injection in a controlled environment.
4. to analyze security threats using penetration testing tools

Text Books

1. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.

2. Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India, 2010.

Reference Books

1. **Ethical Hacking a Handson introduction to breaking In** by Daniel Graham, Published by No Starch Press, 2021.
2. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, “Gray Hat Hacking The Ethical Hackers Handbook”, 3rd Edition, McGraw-Hill Osborne Media paperback (January 27, 2011).

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CST6005 **Course: Program Elective –III: Software TestingL: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits: 3**

Course Objectives

1. To familiarize the students with the strong fundamental knowledge of software testing and practices.
2. To understand the strategies and approaches of Industry Level Testing.
3. To enable the students to apply the advanced testing approaches on Live applications and to channelize solutions to challenging real- world problems.

Syllabus

UNIT – I:

Fundamentals of Software Testing: Introduction to Software Testing, Software Development Life Cycle (SDLC) & Testing Life Cycle (STLC), Testing Principles & Objectives, Defect, Bug, Error, and Failure, Test Plan, Test Case, and Test Strategy, Verification vs. Validation, Levels of Testing i.e. Unit Testing, Integration Testing, System Testing, Acceptance Testing, Types of Testing i.e. Manual vs. Automation, Functional vs. Non-Functional, Black Box vs. White Box Testing, Regression & Smoke Testing, Alpha & Beta Testing.

UNIT – II:

Test Case Design & Execution: Agile Methodology, Writing Effective Test Cases, Test Data & Test Environment Setup, Equivalence Partitioning & Boundary Value Analysis, Decision Table Testing & State Transition Testing, Error Guessing Technique, Test Execution & Bug Reporting, Defect Life Cycle & Bug Tracking Tools (JIRA, Bugzilla), Test Metrics & Reporting.

UNIT –III:

Database Testing: Approach For Database testing, Introduction of basic of Database commands (DDL, DML, DCL), Application of Software Testing Techniques in Database Testing, Types of testing perform in DB i.e. White box testing and Black Box Testing, Typical Test scenario in DB Testing.

UNIT –IV:

Automation Testing & Tools: Introduction to Automation Testing, Benefits & Challenges of Automation, Introduction to Selenium WebDriver, Writing First Test Script in Selenium, Handling Elements (Buttons, Text Fields, Dropdowns, Alerts), Data-Driven Testing using Excel, CI/CD in Testing (Jenkins, Git).

UNIT –V:

API Testing & Performance Testing: Introduction to API Testing, Basics of REST APIs and HTTP Methods (GET, POST, PUT, DELETE), Testing APIs using Postman, Introduction to Performance Testing, Load Testing using Apache JMeter.

Course Outcomes:

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

1. Understand core software testing principles, methodologies, and techniques to ensure software quality and reliability.
2. Design and execute effective test cases using various test case design techniques to ensure comprehensive test coverage and defect identification.
3. Implement database testing techniques to ensure robust, secure, and high-performing backend systems.
4. Utilize automation testing tools to design and execute test scripts, enhancing software testing efficiency and reliability.
5. Apply API and performance testing techniques to ensure functionality, reliability, and scalability of software systems.

Text Books

1. Software Testing: A Craftsman’s Approach, Paul C. Jorgensen, Auerbach Publications; 4th edition, 2013.
2. Foundations of Software Testing, Aditya P. Mathur, Pearson, 1st edition, 2011.
3. The Art of Software Testing, Glenford J. Myers, Tom Badgett, Corey Sandler, John Wiley & Sons Inc; 3rd edition, 2011.

Reference Books

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, Bruce R. Maxim Dr., McGraw Hill, 8th edition, 2014.
2. Software Testing: Principles and Practices, Srinivasan Desikan & Gopalaswamy Ramesh, Pearson, 1st edition, 2005.
3. Practical Software Testing: A Process-Oriented Approach, Ilene Burnstein, Springer-Nature New York Inc, 1st Edition, 2003.
4. Software Testing Techniques, Boris Beizer, Wiley India, Second edition 2002.

Syllabus for Semester VI, B. Tech. Computer Science & Engineering

Course Code: CSP6005 **Course: Program Elective –III: Software Testing Lab**
L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week **Total Credits: 1**

Course Objectives

1. To gain hands-on experience in designing, executing, and automating test cases to ensure software quality.
2. To utilize manual and automated testing tools for functional, database, API, and performance testing.
3. To enable the students to gain practical knowledge and hands-on experience in software testing methodologies and tools, preparing them for industry roles in quality assurance and software testing.

Course Outcomes:

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

1. Demonstrate an understanding of software testing principles, testing life cycle, and defect management.
2. Design, document, and execute effective test cases using various test design techniques.
3. Perform database testing to ensure data accuracy, consistency, and constraint validation using SQL queries.
4. Utilize automation tools to develop and execute test scripts, enhancing test coverage and efficiency.
5. Implement API testing and performance testing methodologies to ensure software reliability and scalability.

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Course Code: CST6006 **Course: Customer Relationship Management**
L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits: 2**

Course Objectives

1. To make the students understand the organizational need, benefits and process of creating long-term value for individual customers.

2. To disseminate knowledge regarding the concept of Salesforce and Salesforce technologies.

3. To enable the students understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

Syllabus

UNIT I:

Introduction to CRM and Salesforce : Definition and importance of CRM, Key CRM concepts, Benefits of CRM for businesses, Introduction to Salesforce, Salesforce's role in business processes, Salesforce Cloud offerings , Overview of Salesforce architecture, Multi-tenant cloud architecture, Salesforce Data Model (Objects, Records, Fields), Understanding Tabs, Apps, and Objects

UNITII:

Salesforce Administration Basics : Understanding Salesforce Setup menu, Creating and managing users, Profiles, Roles, and Permission Sets, Organizing security settings (Organization-Wide Defaults, Sharing Rules), Data Validation Rules, Creating and customizing Objects, Object Relationships, Creating and managing Fields, Workflow Rules, Process Builder, and Flow.

UNIT III:

Introduction to Apex Programming : Apex basics (Syntax, Variables, Methods), Apex classes and triggers, Working with SOQL and SOSL (Salesforce Object Query Language, Handling exceptions in Apex, Apex Triggers, Writing Apex triggers to handle database events, Trigger context variables and best practices, Governor limits and optimization techniques.

UNIT IV:

Advanced Salesforce Development – Lightning Web Components (LWC) : Overview of Lightning Web Components (LWC), LWC architecture and lifecycle, Creating and deploying LWC components, Handling events in LWC, Working with Apex from LWC, LWC Integration with Salesforce Data, Displaying Salesforce data in LWC, Handling record pages and lightning layouts, Best practices for LWC development.

UNIT V:

Salesforce Integration and Deployment, Salesforce Reports: Overview of integration in Salesforce, Integration tools: REST API, SOAP API, and Bulk API, Salesforce Connect, Introduction to Mulesoft for Salesforce integration, Introduction to Salesforce DX, Source-driven development and version control, Continuous Integration and Continuous Delivery (CI/CD) in Salesforce., Introduction to reports, types of

reports, report builder, formatting reports, dashboard introduction, dashboard generation, charts in dashboards, limitations of Salesforce reports.

Course Outcomes:

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

7. Understand the fundamentals of Salesforce and its role in CRM.
8. Gain practical skills in configuring and managing Salesforce environments.
9. Apply the basics of Salesforce development using Apex to customize the platform.
10. Develop modern web applications on the Salesforce platform using Lightning Web Components.
11. Integrate Salesforce with external systems and deploy applications in a production environment.

Text Books

1. Jason Ouellette; Development with the Force.com Platform, Second Edn, Addison Wesley, 2011. 2. Mohith Shrivastava; Salesforce Lightning Application Development, 2018.
2. Mohith Shrivastava; Salesforce Lightning Application Development, 2018
3. Judith W .Kincaid , Customer Relationship Management Getting it Right, Pearson Education
4. Customer Centricity –Focus on right customer for strategic advantage, by Peter Fader, Wharton Digital Press, 2012

Reference Books

1. Learning Salesforce Development with Apex – Paul Battisson
2. Salesforce for Beginners – Sharif Shaalan

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Course Code: CSP6007 **Course: Mini Project**
L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits: 2**

Course Objectives

The objective of Mini project is to let the students map and utilize the technical knowledge acquired in the previous semesters to solve a real-world problem through team effort.

Course Outcomes:

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

1. Identify and finalize the problem statement by investigating various domains and society needs.

2. Perform requirement analysis and design methodology for solving the identified problem.

3. Apply programming techniques and modern tools for the development of the solution.

4. Apply ethical principles, project management skills and demonstrate the ability to work in teams for project development within the confines of a deadline.

5. Communicate technical information employing written reports and presentations.