RAMDEOBABA UNIVERSITY
[RBU]
NAGPUR – 440013

RAMDEOBABA UNIVERSITY, NAGPUR
Formerly Shri Ramdobaba College of Engineering & Management (RCOEM) Est. 1984

PROGRAMME SCHEME & SYLLABI

B. Tech Computer Science & Engineering
[Artificial Intelligence & Data Science]

2024-25

School of Computer Science & Engineering

Department Vision

To continually improve the education environment, in order to develop graduates with strong academic and technical background needed to achieve distinction in the discipline. The excellence is expected in various domains like workforce, higher studies or lifelong learning.
To strengthen links between industry through partnership and collaborative development works.

Department Mission

To develop strong foundation of theory and practices of computer science amongst the students to enable them to develop into knowledgeable, responsible professionals, lifelong learners and implement the latest computing technologies for the betterment of the society.

Programme Outcomes

Engineering graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. Tech. Computer Science and Engineering
(Artificial Intelligence & Data Science)
[2024-25]
Teaching & Evaluation Scheme [B. Tech CSE-AIDS]

Semester - I

Sr. No.	Course Type	Course Code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/Internal Evaluation	Total	
1	ESC	24CS01TH0101	Fundamentals of Programming	3	0	3	50	50	100	3
2	ESC	24CS01PR0101	Fundamentals of Programming Lab	0	2	1	25	25	50	-
3	PCC	24EE01TH0107	Computer Architecture and Organization	3	0	3	50	50	100	3
4	VSEC	24CS01PR0103	Computer Workshop–I Lab	0	2	1	25	25	50	-
5	ESC	24CS01PR0104	Fundamentals of Linux OS Lab	0	2	1	25	25	50	-
6	VEC	24CS01TH0105	Cyber Laws & Ethics in IT	2	0	2	50	50	100	2
7	BSC	24HS03TH0103	Probability and Statistics	3	0	3	50	50	100	3
8	BSC	24HS03PR0103	Computational Mathematics Lab for CSE	0	2	1	25	25	50	-
9	VEC	24HS02TH0104	Foundational Course in Universal Human Values	1	0	1	50	-	50	-
10	BSC	24HS05TH0102	Introduction to Quantum Computing	3	0	3	50	50	100	3
11	BSC	24HS05PR0102	Introduction to Quantum Computing Lab	0	2	1	25	25	50	-
			TOTAL	**15**	**10**	**20**	**-**	**-**	**800**	**-**

Semester – II

Sr. No	Course Type	Course code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/Internal Evaluation	Total	
1	ESC	24CS01TH0201	Object Oriented Programming	3	0	3	50	50	100	3
2	ESC	24CS01PR0201	Object Oriented Programming Lab	0	2	1	25	25	50	-
3	PCC	24CS01TH0202	Data Structures	3	0	3	50	50	100	3
4	PCC	24CS01PR0202	Data Structures Lab	0	2	1	25	25	50	-
5	VSEC	24CS01PR0203	Computer Workshop–II Lab	0	2	1	25	25	50	-
6	PCC	24CS01TH0204	Operating Systems	3	0	3	50	50	100	3
7	PCC	24CS01PR0204	Operating Systems Lab	0	2	1	25	25	50	-
8	BSC	24HS03TH0214	Calculus and Linear Algebra	3	0	3	50	50	100	3
9	IKS	24HS02TH0203	Foundational Literature of Indian Civilization	1	0	1	50	-	50	-

10	BSC	24HS02PR0202	Professional Communication Lab	0	2	1	25	25	50	-
11	CCA	24HS04PR0201	Sports-Yoga-Recreation	0	2	1	25	25	50	-
12	VEC	24HS01TH0202	Environmental Science	1	0	1	50	-	50	-
13	VEC	24HS01PR0202	Environmental Science Lab	0	2	1	25	25	50	-
14	CCA	24HS02PR0206-1 to 16/ 24HS04PR0202-1 to 4/	Liberal/Performing Art	0	2	1	25	25	50	-
			TOTAL	**14**	**16**	**22**	**-**	**-**	**900**	**-**

- **Courses Highlighted in Yellow [05 credits] will be swapped between Group-1 and Group-2 sections.**

Liberal/ Performing Art Bucket

Sr. No.	Course Code	Course Title	L	P	Credits	Continuous Evaluation	End Sem Exam/ Internal Evaluation	Total	ESE Duration
1	24HS02PR0206-01	Fundamentals of Indian Classical Dance: Bharatnatayam	0	2	1	25	25	50	-
2	24HS02PR0206-02	Fundamentals of Indian Classical Dance: Kathak	0	2	1	25	25	50	-
3	24HS02PR0206-03	Introduction to Digital Photography	0	2	1	25	25	50	-
4	24HS02PR0206-04	Introduction to Basic Japanese Language	0	2	1	25	25	50	-
5	24HS02PR0206-05	Art of Theatre	0	2	1	25	25	50	-
6	24HS02PR0206-06	Introduction to French Language	0	2	1	25	25	50	-
7	24HS02PR0206-07	Introduction to Spanish Language	0	2	1	25	25	50	-
8	24HS02PR0206-08	Art of Painting	0	2	1	25	25	50	-
9	24HS02PR0206-09	Art of Drawing	0	2	1	25	25	50	-
10	24HS02PR0206-10	Nature Camp	0	2	1	25	25	50	-
11	24HS02PR0206-11	Developing Self-awareness	0	2	1	25	25	50	-
12	24HS02PR0206-12	Art of Poetry	0	2	1	25	25	50	-
13	24HS02PR0206-13	Creative and content writing	0	2	1	25	25	50	-
14	24HS02PR0206-14	Science of life through Bhagwad Gita	0	2	1	25	25	50	-
15	24HS02PR0105-15	Sanskrit	0	2	1	25	25	50	-

		Sambhashan Spoken Sanskrit							
16	24HS02PR0105-16	Kirtan Kala	0	2	1	25	25	50	-
17	24HS04PR0202-1	Adventure Sports	0	2	1	25	25	50	-
18	24HS04PR0202-2	Introduction to Defense Forces & Obstacle Training	0	2	1	25	25	50	-
19	24HS04PR0202-3	Self Defense and Indian Martial Arts	0	2	1	25	25	50	-
20	24HS04PR0202-4	Basic Nutritional Course	0	2	1	25	25	50	-

Semester - III

Sr. No.	Course Type	Course Code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/ Internal Evaluation	Total	
1	PCC	24CS02TH0301	Theory of Computation	3	0	3	50	50	100	3
2	PCC	24CS02TH0302	Database Management System	3	0	3	50	50	100	3
3	PCC	24CS02PR0302	Database Management System Lab	0	2	1	25	25	50	-
4	PCC	24CS02PR0303	Data Exploration and Visualization Lab	0	4	2	25	25	50	-
5	PCC	24CS02TH0304	Network and Communication	3	0	3	50	50	100	3
6	PCC	24CS02PR0304	Network and Communication lab	0	2	1	25	25	50	-
7	BSC	24HS03TH0301	Discrete Mathematics and Graph Theory	3	0	3	50	50	100	3
8	OE		Open Elective-I	2	0	2	50	50	100	3
9	MDM		MDM-I	3	0	3	50	50	100	3
			TOTAL	**17**	**8**	**21**	**-**	**-**	**750**	**-**

Semester - IV

Sr. No.	Course Type	Course code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/ Internal Evaluation	Total	
1	PCC	24CS02TH0401	Data Science and Programming	3	0	3	50	50	100	3
2	PCC	24CS02PR0401	Data Science and Programming Lab	0	4	2	25	25	50	-
3	PCC	24CS02TH0402	Design and Analysis of Algorithms	3	0	3	50	50	100	3
4	PCC	24CS02PR0402	Design and Analysis of Algorithms Lab	0	2	1	25	25	50	-
5	PCC	24CS02TH0403	Artificial Intelligence	3	0	3	50	50	100	3
6	PCC	24CS02PR0403	Artificial Intelligence Lab	0	2	1	25	25	50	-
8	OE		Open Elective-II	2	0	2	50	50	100	3
9	CEP	24CS02PR0404	Community Engagement Project	0	4	2	25	25	50	-
10	VEC	24CS02TH0405	Creativity, Innovation & Design Thinking	2	0	2	50	-	50	-
11	AEC	24CS02PR0406	Basic Competitive Coding	0	2	1	50	-	50	-
12	MDM		MDM-II	3	0	3	50	50	100	3
			TOTAL	**16**	**14**	**23**	**-**	**-**	**800**	**-**

Semester - V

Sr. No.	Course Type	Course Code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/Internal Evaluation	Total	
1	PCC	24CS02TH0501	Machine Learning for DS	3	0	3	50	50	100	3
2	PCC	24CS02PR0501	Machine Learning for DS Lab	0	2	1	25	25	50	-
3	PCC	24CS02PR0502	Statistical Inference Lab	0	4	2	25	25	50	-
5	PCC	24CS02TH0503	Big data Analytics	3	0	3	50	50	100	3
6	PCC	24CS02PR0503	Big data Analytics Lab	0	2	1	25	25	50	-
7	PCC	24CS02TH0504	Software Engineering and Testing Methodologies	3	0	3	50	50	100	3
8	PCC	24CS02PR0504	Software Engineering and Testing Methodologies Lab	0	2	1	25	25	50	-
9	EEM	24CS02PR0505	Idea Lab	0	2	1	25	25	50	-
10	PEC	24CS02PR0506	Program Elective-I	3	0	3	50	50	100	3
11	OE		Open elective-III	2	0	2	50	50	100	3
12	MDM		MDM-III	3	0	3	50	50	100	3
			TOTAL	**17**	**12**	**23**	**-**	**-**	**850**	**-**

Semester - VI

Sr. No.	Course Type	Course code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/Internal Evaluation	Total	
1	PCC	24CS02TH0601	Deep Learning	3	0	3	50	50	100	3
2	PCC	24CS02PR0601	Deep Learning Lab	0	2	1	25	25	50	-
3	PCC	24CS02TH0602	Computer Vision	3	0	3	50	50	100	3
4	PCC	24CS02PR0602	Computer Vison Lab	0	2	1	25	25	50	-
5	PEC	24CS02TH0603	Program Elective –II	3	0	3	50	50	100	3
6	PEC	24CS02TH0604	Program Elective –III	3	0	3	50	50	100	3
7	PCC	24CS02PR0605	Comprehensive Viva	0	2	1	50	-	50	-
8	AEC	24HS02TH0601	Business Communication	1	0	1	50	-	50	-
9	AEC	24HS02PR0601	Business Communication Lab	0	2	1	25	25	50	-
10	VSEC	24CS02PR0606	Mini Project	0	4	2	25	25	50	-
11	AEC	24CS02PR0607	Advanced Competitive Coding	0	2	1	50	-	50	-
12	MDM		MDM-IV	3	0	3	50	50	100	3
			TOTAL	**16**	**14**	**23**	**-**	**-**	**850**	**-**

Semester – VII/VIII

Sr. No.	Course Type	Course Code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam /Internal Evaluation	Total	
1	PCC	24CS02TH0701	Knowledge Discovery & Mining	3	0	3	50	50	100	3
2	PCC	24CS02PR0701	Knowledge Discovery & Mining Lab	0	2	1	25	25	50	-
3	PCC	24CS02TH0702	Large Language Model	3	0	3	50	50	100	3
4	PCC	24CS02PR0702	Large Language Model Lab	0	2	1	25	25	50	-
5	PCC	24CS02TH0703	Cloud Powered AI	2	0	2	50	50	100	3
6	PEC	24CS02TH0704	Program Elective-IV	3	0	3	50	50	100	3
7	PRJ	24CS02PR0705	Major Project-1	0	8	4	50	50	100	-
8	AEC	24CS02PR0706	Participative Learning	0	2	1	50	-	50	-
9	Internship	24CS02PR0707	Internship Evaluation [Min 6 Weeks]	-	-	-	-	-	-	-
			TOTAL	**11**	**14**	**18**	**-**	**-**	**650**	**-**

Semester – VIII/VII

Sr. No.	Course Type	Course code	Course Name	Hours/ Week		Credits	Maximum marks			ESE Duration (Hrs)
				L	P		Continuous Assessment	End Sem Exam/ Internal Evaluation	Total	
1.	PEC	24CS02TH0801	Program Elective-V/NPTEL/SWAYAM	3	0	3	50	50	100	3
2.	PEC	24CS02TH0802	Program Elective-VI/NPTEL/SWAYAM	3	0	3	50	50	100	3
3.	PRJ	24CS02PR0803	Major Project-2	0	12	6	50	50	100	-
			TOTAL	**6**	**12**	**12**	**-**	**-**	**300**	**-**
							Continuous Evaluation	**Industry Evaluation**	**Total**	
1.	Internship	24CS02PR0804	Industry Internship/Research Internship/TBI	**0**	**24**	**12**	**100**	**100**	**200**	

Electives Basket

Micro Specialization	Elective-I [V Sem]	Elective-II [VI Sem]	Elective-III [VI Sem]	Elective-IV [VII Sem]	Elective-V [VIII Sem]	Elective-VI [VIII Sem]
AI & ML	**Applied Computation Statistics**	**Applied Artificial and Expert System**	**Time Series Analysis and Forecasting**	**Distributed and Parallel Computing**	**Graph Neural Networks**	**Generative AI**
Blockchain	Cryptography	Introduction to Blockchain Technologies	Smart Contracts	Blockchain for AI	Cloud Security Analysis	Digital Forensics and Malware Analysis
Image Processing and NLP	Digital Image Processing	Natural Language Processing	Video Analysis	Automatic Speech Recognition	Medical Image Analysis	Transformer based Natural Language Processing
Full Stack	No SQL Database Enterprise	Web Applications	Mobile Application Development	Middleware Frameworks and ORM	Devops in Artificial Intelligence and Data Science	Micro Service Based Application

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01TH0101 **Course: Fundamentals of Programming**

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

Course Objectives:
The objective of this course is to develop logical thinking and problem-solving techniques.

Unit I:
Algorithm and Flowchart for problem-solving, Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Decision Control Statement- if and Conditional operators.

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

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

Unit IV:
Arrays: 1-D, 2-D, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Pointers to the array, Command line arguments. User Defined Data Types: Structures, enum, union

Unit V:
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 ().

Course Outcomes

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

1. Design logical solutions for problem statements using flowcharts and algorithms.
2. Develop solution for problem statements involving decision-making and loops.
3. Apply the concept of functions for modular programming.
4. Implement solutions for problem statements using arrays and structures.
5. Perform file operations.

Text Books:

1. The C Programming Language: B. W. Kernighan and D. M. Ritchie, Second Edition, Pearson, June 2015
2. Programming in ANSI C: E. Balguruswami McGraw Hill

Reference Books

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01PR0101 **Course: Fundamentals of Programming Lab**

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

- Practical's will be conducted based on Syllabus of Fundamentals of Programming [**24CS01TH0101]**

Course Outcomes

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

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24EE01TH0107 **Course: Computer Architecture and Organization**

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

Course Outcomes:

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

1. Explain the basic structure and operation of a computer system.
2. Analyze Instruction Set Architecture and Arithmetic Operations
3. Evaluate Memory Hierarchy and Management
4. Demonstrate I/O organization, data transfer methods, and interrupt handling.
5. Apply the knowledge of computer architecture principle to comprehend advance computing architectures

SYLLABUS

UNIT I:

Fundamentals of Computer Architecture:

Number Systems and their operations, Floating Point number representation, Basics of Computer Architecture and Organization, Evolution of Computing System, Performance Metrics (MIPS, FLOPS, CPI, IPC, Execution time).

UNIT II:

Instruction Set Architecture and Arithmetic Operations:

Instruction Execution cycle, Instruction Set Architecture, addressing modes, Instruction set classification, Pipelining Architecture, Multiplication: Booth's Algorithm, Bit-pair recoding, Integer Division: Restoring and non-restoring division.

UNIT III:

Memory Hierarchy and Management:

Memory hierarchy, Types of memory in Computer System and their Characteristics, Cache memory: Mapping functions, Replacement policies, Virtual Memory: Paging and Segmentations, Memory interleaving

UNIT IV:

Input/output Organization:

Introduction to I/O systems: I/O interface and bus systems, Modes of data Transfer: Program I/O, Interrupt driven I/O and Direct Memory access (DMA), I/O addressing Techniques, Interrupts: Interrupts and interrupt handling mechanisms.

UNIT V:

Advanced Computer Architectures and Parallel Processing:

Pipelining and Super Scalar Execution, Parallel processing and Multicore Architecture, Flynn’s Taxonomy for parallel architectures, GPUs and their role in modern computing.

Text Books

1. V.C. Hamacher, Z.G. Vranesic and S.G. Zaky; Computer Organization; 5th edition; McGrawHill,2002.
2. W. Stallings; Computer Organization & Architecture; PHI publication; 2001.

Reference Books

1. M Mano; Computer System and Architecture; PHI publication; 1993. A.S. Tanenbaum; Structured Computer Organization; Prentice
2. J. P. Hayes; Computer Architecture & Organization; 3rdedition; McGraw-Hill; 1998.

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code : 24CS01PR0103 **Course : Computer Workshop-I Lab**

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

Course Outcomes

On successf

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

1. Perform Data Analysis using MS Excel.
2. Design static web pages using HTML.
3. Demonstrate proficiency in web page styling.
4. Develop websites using MS Excel, HTML and CSS

MS Excel

Complex formulas: INDEX-MATCH and array formulas, Pivot tables for comprehensive data analysis, Advanced charting for dynamic data visualization, Conditional formatting for data insights, Automating tasks with macros, Data validation for error-free data entry

HTML

Creation of headers, paragraphs, links, importing of images, tables, designing of forms, and document structure of HTML.

HTML-5

Navigation in Webpage, Multimedia based tags- audio, video, iframe, Creating Animations.

CSS & Bootstrap

Introduction to Cascading Style Sheets, Features, Core syntax, Style Sheets and HTML StyleRule, Text Properties

Text Books

1. Microsoft Excel 2019: Data analysis and Business Modelling, Wayne Winston, Microsoft Press, 6th edition 2019.
2. HTML & CSS: The Complete Reference, Thomas Powell, MGH, 5th edition, 2017.
3. Bootstrap 5 Foundations, Daniel Charles Foreman, Independently published, 2021.

Reference Books

1. Mastering Advanced Excel, Ritu Arora, BPB Publications, 2023.
2. HTML and CSS: Design and Build Webs, Jon Duckett, Wiley, 1st edition, 2011.
3. Web Design: A Beginner’s Guide, Wendy Willard, MGH, 2nd edition, 2010.

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01PR0104 **Course: Fundamentals of Linux OS Lab**

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

Course Objectives:

The course on Open-Source Software Tools aims to provide a comprehensive understanding and practical skills in open-source software. Students will explore the history, principles, and significance of open source. The course covers hands-on experience with popular open-source operating system and software tools. Through this course, students will gain the knowledge and skills to effectively utilize and contribute to the open-source ecosystem.

Course Outcomes

Upon completion of the course, students will be able to

1. Understand the architecture and use of Linux operating system.
2. Effectively use different services provided by Linux operating system.
3. Automate tasks and write simple programs using shell scripts.
4. Use popular IDEs for program development.

Linux Operating System:

- Introduction and history of Linux OS
- Basic commands
- File system and file handling commands
- User, Group management commands
- Process handling commands
- Package management
- Shell and shell script

Introduction to popular IDEs, Git

Text Book

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

Reference Books

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01TH0105 **Course: Cyber Laws & Ethics in IT**

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

Course Outcomes

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

1. To analyze the role of ethics in IT organization.
2. To identify various cyber laws with respect to legal dilemmas in the Information Technology field.
3. To interpret various intellectual property rights, Privacy, Protection issues in Information Technology field.
4. To describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Syllabus:

UNIT I

Ethics in business world & IT professional malpractices, Introduction to firewalls, IDS System, Distortion and fabrication of information

UNIT II

Ethics of IT Organization: Contingent Workers H- IB Workers, Whistle- blowing, Protection for Whistle- Blowers, Handling Whistle- blowing situation, Digital divide.

UNIT III

Intellectual Property: Copyrights, Patents, Trade Secret Laws, Key Intellectual property issues, Plagiarism, Privacy: The right of Privacy, Protection, Key Privacy and K- Anonymity issues, Identity Theft, Consumer Profiling,

UNIT IV

Cyber laws and rights in today's digital age, Emergence of Cyberspace, Cyber Jurisprudence, Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber terrorism, cyber tort, Cyber Defamation & hate speech,Competitive Intelligence, Cybersquatting, The indian information technology act 2000 IT Act.

Text Books:

1. George Reynolds, “Ethics in information Technology”,5th edition, Cengage Learning
2. Hon C Graff, Cryptography and E-Commerce - A Wiley Tech Brief, Wiley Computer Publisher, 2001.

Reference Books:

1.Michael Cross, Norris L Johnson, Tony Piltzecker, Security, Shroff Publishers and Distributors Ltd.

2.Debora Johnson,” Computer Ethic s”,3/e Pearson Education.

3.Sara Baase, “A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet,” PHI Public at ions.

4.Chris Reed & John Angel, Computer Law, OUP, New York, (2007).

5.Dr Pramod Kr.Singh, “Laws on Cyber Crimes [Along with IT Act and Relevant Rules]” Book Enclave Jaipur India.

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS03TH0103 **Course: Probability and statistics**

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

Course Pre-requisite: Basics of Probability and Statistics**.**

Course Objective:

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

Course Outcomes

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

1.Grasp the meaning of discrete and continuous random variables, probability distribution. Interpret the meaning of probabilities derived from distributions. This involves understanding what the calculated probabilities represent in practical terms and drawing conclusions from the results.

2.To analyze and interpret stochastic models, including calculating probabilities, transition probabilities, and steady-state probabilities within stochastic systems.

3. Grasp the fundamental concepts of curve fitting like regression techniques, model selection, and the use of different types of curves or functions to approximate data.

4.Understand the fundamental concept of hypothesis testing, including the null hypothesis (H0) and alternative hypothesis (H1), significance levels, p-values, and the basic logic behind hypothesis testing.

5.To apply MLE to various statistical models, such as linear regression, exponential distribution, etc. They should understand how to formulate likelihood functions and derive estimators for unknown parameters.

Syllabus

Module 1:

Measure of central tendency, quartile, inter quartile range and outliers**,** Probability spaces, conditional probability, independence, Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution and their applications.

Module 2:

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

Module 3:

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

Module 4:

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

Module 5:

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

Text Books:

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

Reference Books:

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS03PR0211 Course: Computational Mathematics Lab

L: 0 Hrs, T: 0 Hr, P: 2Hr, 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:

Course Outcomes:

By using open source software Students will be able to
CO1: Utilize mathematical software as an advanced calculator to create and manipulate 2D and 3D plots in SageMath, enabling effective visualization and interpretation of data
CO2 Recognizing, solving, and applying recurrence relations to a wide range of computational problems
CO3: Use partial derivatives and gradients for optimizing multivariable functions
CO4 :Apply linear algebra concepts, including matrix representations and Singular Value Decomposition (SVD), for image processing and dimensionality reduction.
CO5 Understand different curve fitting techniques, such as linear, polynomial, and exponential fitting and learn how to choose the appropriate curve fitting method based on the data characteristics.
CO6 Understand and articulate the fundamental concepts and purposes of hypothesis testing in data analysis.

Mapping of Course outcomes (COs) with Experiments

Exp. No.	Name of Experiments	Mapped COs
1	To use mathematical software as an advance calculator and for visualization of data	CO1
2	2D - 3D Plotting and data visualization	CO1
3	Exploring Recurrence Relations in Computational Algorithms	CO2
4	Applied optimization (Maxima, minima and Gradient descent method)	CO3
5	Application of Matrices in image processing	CO4
6	Linear Algebra with Various applications (computer Graphix, cryptography ,stochastic process)	CO4
7	Curve Fitting to identify trends and patterns within dataset .	CO5
8	Validating Hypotheses in Data Analysis	CO6

Reference:

1. Paul Zimmermann, Computational Mathematics with Sagemath , siam publisher.

Syllabus for Semester I, B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]

Course Code :24HS02TH0104 Course : Foundation course in Universal Human Values

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

Course Objectives:

1. To help the student see the need for developing a holistic perspective of life
2. To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
3. To strengthen self-reflection
4. 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:

1. Develop a holistic perspective of life
2. Better understanding of inter-personal relationships and relationship with society and nature.
3. 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

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 I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code:24HS05TH0102 **Course: Introduction to Quantum Computing**

L: 3 Hrs, P: 0Hr, 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 Chuang, Cambridge University Press 2010

Syllabus for Semester I, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code:24HS05PR0102 Course: Introduction to Quantum Computing Lab

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

Course Outcomes:

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

On completion of the course, the students will be able to
1.Utilise Mathematica software for graph plotting and for least squares fitting of the experimental data.
2.Explore Quantum Systems.
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 and Design programmes on IBM Quantum Computers.

The laboratory will consist of general computational physics practical.

1. Linear and Nonlinear data fitting and Error analysis by LLSF method
2. Analysing the complex behaviour of Wave packets
3. Understanding the Eigen values, Eigen functions of 1-D Quantum Well.
4. Working with Vectors.
5. Working with Matrices: Real and Complex numbers.
6. Properties of Unitary and Hermitian Matrices, Inner Product, Tensor Product etc.
7. Simulation of Classical gates by Quantum representation of the gates and inputs.
8. Introduction to IBM quantum computer.
9. Simulation of Quantum gates: CNOT gate, Toffoli gate, Fredkin gate, Hadamard gate on IBM quantum computer.
10. Arithmetic operations using IBM Quantum computer.
11. Quantum Half adder and Full Adders.

Reference Books

1. Lab manual prepared by Physics Department, RCOEM, Nagpur.
2. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01TH0201 **Course: Object Oriented Programming**

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

Course Objectives

1. To make students understand the Fundamental features of an object-oriented language like Java: object classes and interfaces, exceptions, and libraries of object collections
2. Introduce students to 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, constructors, and methods, Constructor Overloading

Unit II:

Method Overloading, Arrays and Array of objects, Wrapper classes (Integer, Double etc.), String Class, creating packages, importing packages, access specifiers, static and non-static members.

Unit III:

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, overriding, run time polymorphism, abstract classes and methods, Interface, implementation of interface.
Lambda Expressions Introduction, Block, Passing Lambda expression as Argument

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: type-safety, generic class with two type parameters, bounded generics, wildcard, and generic method.
Collection classes: Arraylist, TreeSet, HashMap, Iterator, ListIterator, Collections class, Comparator, Comparable
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. Apply object-oriented principles such as abstraction, encapsulation, inheritance, and polymorphism to develop efficient Java programs.
2. Illustrate various Java constructs, including constructors, methods, arrays, wrapper classes, packages, and lambda expressions, for effective program development.
3. Implement exception handling mechanisms and Java streams for robust and error-free programming.
4. Utilize generics and collections to develop scalable and maintainable software

solutions.

5. Analyze the characteristics, significance, and application of design patterns in the software development 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. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw- Hill Education Private Ltd 2013.
2. Core Java Volume I – Fundamentals" by Cay S. Horstmann and Gary Cornell

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01PR0201 Course: Object Oriented Programming Lab

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

- Practical's will be conducted based on Syllabus of Object-Oriented Programming [24CS01TH0201]

Course Objectives

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

Course Outcomes:

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

1. Execute java programs using the concepts such as classes, objects, methods, wrapper classes, and packages to enhance code reusability and modularity.
2. Develop reusable and modular code solutions by implementing inheritance and interfaces
3. Implement robust programming practices using exception handling mechanisms and Java streams for effective error handling and file operations.
4. Utilize generics and collection classes to data management and software scalability

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01TH0202 **Course: Data Structures**

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

Course Objectives

1. To introduce the basic concepts of data structures and algorithms.
2. To prepare students to use linear and non-linear data structures.
3. To familiarize students with different searching and sorting techniques.
4. To enable students to use appropriate data structure for solving real-world problems.

SYLLABUS

UNIT-I:

Data Structures and Algorithm Basics

Introduction: Elementary data organizations and operations on it. Abstract data types (ADT) and their characteristics.

Algorithms: Characteristics, Asymptotic notations, time and space trade-offs, Analysis of algorithm.

Array ADT: Representations – row-major and column-major form, Dynamic Arrays, Implementation of Real-life problems using arrays.

UNIT-II:

Stacks and Queues

Stack ADT: Stack implementation using arrays, Applications of stacks – expression conversion and evaluation, implementation of multiple stacks, Real life problem implementation using stacks.

Queue ADT: Queue implementation using arrays, Circular queue, Real life problem implementation using Queue, introduction to double-ended queues and priority queues.

UNIT-III:

Linked Lists

Singly Linked Lists (SLL): Creation of SLL, Operations on SLL: Insertion, Deletion, Traversal, reversal, ordering, etc., Linked representation of stacks and queues, Header node linked lists.

Doubly and Circular Linked Lists (DLL and CLL): Creation of Linked list and operations on it.

UNIT-IV:

Trees and Graphs

Trees: Terminologies, Binary tree and operations, Binary search tree [BST] and operations, Threaded binary trees.

Self-balancing Search Trees: Tree rotations, AVL tree and operations, B tree, B+- tree and operations.

Introduction to Graphs: Basic terminologies, representation of graphs, graph traversals: depth first search (DFS) and Breadth first search (BFS).

UNIT-V:

Sorting and Searching

Sorting: Internal and External sorting, Concept of Stable sort. Implementation of Shell, quick, merge, heap, counting sort, performance analysis and comparison.

Searching: Revision of linear search, binary search and complexity analysis of search methods. Hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques.

Course Outcomes:

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

1. Analyze the efficiency of algorithms by evaluating their time and space complexities.
2. Design solutions to problems using linear data structures, such as stacks and queues.
3. Implement real-life problems using arrays and linked lists with dynamic memory allocation.
4. Demonstrate nonlinear data structures and their operations, such as trees and graphs.
5. Apply different searching, sorting, and hashing techniques for efficient data organization and retrieval.

Textbooks

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed; Fundamentals of Data Structures in C; Second Edition; Universities Press; 2008.
2. Robert Kruse, C. L. Tondo, Bruce Leung, Sashu Mogalla, Data Structures and Program Design in C; Second Edition; Pearson Education; 2006.
3. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.

References

1. Seymour Lipschutz; Data Structures; First Edition; McGraw Hill; 2006.
2. Yedidyah Moshe, J. Augenstein, Aaron M. Tenenbaum; Data Structures Using C; Second Edition; PHI publication.
3. Thomas Cormen, Charles Leiserson, Ronald Rivest and Clifford Stein, Introduction to Algorithms, Third Edition; Prentice Hall of India; 2009.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS01PR0202 **Course: Data Structures Lab**

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

- Practical's will be conducted based on Syllabus of Data Structure [24CS01TH0202]

Course Objectives

1. To impart to students the basic concepts of data structures and algorithms.
2. To familiarize students on different searching and sorting techniques.
3. To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
4. To enable students to devise algorithms for solving real-world problems.

Course Outcomes

On completion of the course the student will be able to demonstrate

1. Design solutions to problem using array and dynamic memory allocation.
2. Develop solutions for real life problems using stacks and queues.
3. Implement real-life problems using linked lists.
4. Demonstrate nonlinear data structures and their operations, such as trees and graphs.

Syllabus for Semester II, B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]

Course Code: 24CS01PR0203 Course: Computer Workshop-II Lab

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

Course Outcomes

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

1. Design and develop dynamic web pages using JavaScript
2. Demonstrate PHP database connectivity and perform basic CRUD operations.
3. Apply ES6 features to create interactive and dynamic web designs.
4. Develop high-fidelity designs and prototypes in Figma

JavaScript: Introduction to JavaScript, Syntax, Variables and Data Types, Statements, Operators, Literals, Functions, Objects-Arrays-Built-in Objects, Handling Events in JavaScript, Form creation & validation, PHP database connectivity.

Introduction to ES6: Let and Const Declarations, Arrow Functions and Template Literals, Destructuring and Spread/Rest Operators, Classes and Modules, Exploring array methods.

UX Programming: Figma Basics, Wireframe and Prototype, Digital Storytelling

Text Books

1. JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language, David Flanagan, Shroff/O'Reilly, 7th edition, 2020.
2. PHP & MySQL, Jon Duckett, John Wiley & Sons Inc, 1st edition, 2022.
3. Simply ES6: Mastering JavaScript and ES6 to its fullest, Anna Voice, Ray Voice, Independently published, 2nd edition, 2020.
4. Ultimate Figma for UI/UX Design, Aditi Sharma, Orange Education Pvt. Ltd, 2025.

Reference Books

1. JavaScript: The Complete Reference, Thomas Powell, Fritz Schneider, MGH, 3rd edition, 2012.
2. Exploring ES6, Axel Rauschmayer, Leanpub, 2018.
3. User story mapping, Jeff Patton, O'Reilly Media, 1st edition, 2014.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code : 24CS01TH0204 **Course : Operating Systems**

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

Course Objectives

1. To learn the need and evolution of operating systems.
2. To learn various concepts and issues related to Process management, Memory management and File management.

Syllabus

Unit I:

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls

Process Management: Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching, Types of Schedulers and their role, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SRTF, Priority, RR, Multilevel queue and multilevel feedback queue.

Unit II:

Threads: difference between a process and a thread, Benefits of threads, Types of threads, Concept of multithreads.

Inter-process Synchronization: Critical Section, Race Conditions, Mutual Exclusion, Peterson's solution for synchronization, Hardware Solutions, Semaphores, Monitors, Classical synchronization Problems: Producer-Consumer Problem, Reader-Writer Problem, Dinning Philosopher Problem.

Unit III:

Deadlocks: Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock Detection and Recovery.

Unit IV:

Memory Management: Basic concept, Address binding, Dynamic loading, Dynamic Linking, Swapping, Logical and Physical address mapping, Contiguous Memory allocation – Fixed and variable partition, internal and external fragmentation, Compaction, Non- contiguous Memory allocation: Segmentation: principle of operation, Segment Map table, protection and sharing, Paging: Principle of operation – Page Map table, Hardware support for paging, Protection and sharing, Structure of Page Map table.

Virtual Memory: Concept of Virtual Memory, Instruction Interruptibility, Locality of reference, Demand paging: Page fault, Dirty bit, valid-invalid bit, Page Replacement algorithms: First in First Out, Optimal, Least Recently used, LRU approximation algorithms, counting based page replacement, Page Buffering algorithms, Local Vs Global algorithms, Thrashing, Page allocation strategies to overcome trashing: Working set model and Page Fault Frequency

Unit V:

File Management: Concept of File, Access methods, File types, File operations, Directory structure, File System structure, Allocation methods, Free-space management.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, Boot block, Bad blocks.

Course Outcomes:

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

1. Differentiate between different types of operating systems and different CPU scheduling algorithms
2. Apply the concept of process synchronization in real life problems
3. Identify the occurrence of deadlock and handle it.
4. Apply various memory management techniques
5. Apply various file management techniques

Text Books

1. Operating System Concepts, 8th Edition by A. Silberschatz, P.Galvin, G. Gagne, Wiley India.
2. Modern Operating Systems, 2nd Edition by Andrew Tanenbaum, PHI.

Reference Books:

1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
2. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code : 24CS01PR0204 **Course : Operating Systems Lab**

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

- Practical's will be based on Syllabus of Operating Systems [24CS01TH0204]

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that include architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management.

Course Outcomes:

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

1. Implement system commands by making use of LINUX system calls.
2. Implement processes and process schedulers.
3. Design solutions to process synchronization and deadlock handling.
4. Implement Memory management and File management solutions.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS03TH0214 **Course: Calculus & Linear Algebra**

L: 3 Hrs, 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. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
5. Internalize convergence of sequences and apply it to determine whether infinite series convergent or divergent with appropriate tests.

Syllabus

Module 1 :
Differential Calculus: Functions of univariate , Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem, Taylor's and Maclaurin series.

Module 2:
Partial Differentiation: Partial derivatives, Euler's Theorem, chain rule, application of partial differentiation: total derivative, Jacobians, Maxima, Minima for the functions of two variables., Extrema of function of multivariable,

Module 3:
Vector Calculus: Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, application of vector calculus:Line integral, Gradient Descent method.

Module 4:
Rank-nullity theorem; Consistency of system of linear equations and its solution , Orthogonal matrices, Eigen values and eigenvectors, Diagonalization of matrices, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional vector spaces, Singular value decomposition and its applications.

Module 5:
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 II, B. Tech. Computer Science & Engineering [Artificial Intelligence & Data Science]

Course Code : 24HS02TH0203 Course : Foundational Literature of Indian Civilization

L: 1 Hrs, P: 0 Hrs, Per Week Total Credits: 1

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 and understanding about the foundation of vedic mathematics.

Syllabus

Unit 1:
Overview of Indian Knowledge System:Importance of ancient knowledge, defining IKS, Historicity of IKS, Some unique aspects of IKS.

Unit 2:
The Vedic corpus: Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

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

Unit 4:
Vedic Maths -1:Introduction of Vedic Mathematics, Bodhyan geometry, circular functions, inverse circular functions.

Unit -5:
Vedic Maths – 2:Multiplication of polynomials by *nikhilaṃ* and *ūrdhvatiryagbhyām* sutra. Verification by *Gunitasamuccayaḥ*. Division of two polynomials using *parāvartya yojayet*. HCF and LCM of two polynomials using *ādyamādyenāntyamantyena* and *ānurūpyeṇa.* Factorization of polynomials up-to degree 3 using *ānurūpyeṇa*, *Lopanasthāpanābhyām*, *ādyamādyenāntyamantyena*.

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 II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code : 24HS02PR0202 **Course : Professional Communication Lab**

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

Course Objective

To enhance competency of communication among learners and prepare them for effective workplace communication

Course Outcomes

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

1.Implement essential language skills- listening, speaking, reading, and writing
2.Demonstrate the techniques of effective Presentation Skills
3.Evaluate and apply the effective strategies for Group Discussions and Personal Interviews
4.Effectively implement the comprehensive principles of written communication

Syllabus

List of practicals

Professional Communication-1

Practical 1:

Speaking Skills :This practical will cover the following topics: Effective communication techniques, Role of paralinguistic features viz. pronunciation, stress, intonation and rhythm, Meeting people, Asking questions, types of barriers and techniques to overcome them

Practical 2:

Listening Skills:This practical will cover the following topics: Listening Comprehension, active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening

Practical 3:

Reading:This practical will cover the following topics: Reading Comprehension: types and strategies

Professional Communication-2

Practical 4:

Presentation Skills: Orientation & Mock Session:This practical will cover the following topics: Introduction to professional presentation skills, planning the content, effective delivery, aspects of non-verbal communication, visual designing, tips for effective presentations

Practical 5:

Presentation Skills: Practice

Practical 6:

Group Discussions and Personal Interview: Orientation & Mock Session

This practical will cover the following topics: types of group discussion, strategies for effective group discussion, types of questions in an interview, resume making, use of power words, tips for a successful interview

Practical 7:
Group Discussions and Personal Interview: Practice

Professional Communication-3

Practical 8:
Writing Practices:This practical will cover the following topics: Vocabulary building, Grammar and mechanics

Practical 9:
Writing Practices:This practical will cover the following topics: Sentence and paragraph structures, Note-making

Practical 10:
Writing Practices: This practical will cover the following topics: Academic Correspondence

Reference Books

1. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
2. *Practical English Usage.* Michael Swan. OUP. 1995.
3. *Remedial English Grammar.* F.T. Wood. Macmillan.2007
4. *On Writing Well.* William Zinsser. Harper Resource Book. 2001
5. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code :24HS04PR0201 **Course: Sports Yoga Recreation**

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

Aim of the Course:

The course aims to foster Health and wellness through Healthy and Active Lifestyle and creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness through practical experiences and hands on activities.

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.

Syllabus:

Unit 1:

1.Warm up and Cool Down and Stretching Exercises.
2.General and Specific Exercises.
3.Calculation of BMI & Resting Pulse Rate.
4.General and Specific exercises for strength, Speed, Agility, Cardiovascular Endurance, Flexibility, Coordinative abilities.
5.Practice of Fundamental Skills of Volleyball, Table Tennis and Chess, etc.
6.Knowledge and practice of the Equipment used in a Gymnasium and its application.

Unit 2:

1.Yoga: Standing, Sitting, Prone & Supine positions.
2.Suryanamaskar.
3.Pranayama, Meditation and Relaxation Techniques.
4.Recreational Games.
5.Practice of Fundamental Skills of Basketball, Football, Carrom, etc.
6.Health related Physical Fitness Test.

Assessment Pattern:

Assessment Type	Weightage in Marks	Total Marks
Practical	Physical Efficiency Test – 30 Marks Sports/Games skill Activity/Project – 10 Marks Yoga Activities – 10 Marks	50
	Total – 50 Marks	

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
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Course Code : 24HS01TP0202 **Course : Environmental Science**

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

Syllabus:

Unit 1:

Sustainability Engineering:

Multidisciplinary nature of Environmental Science, air and water pollution; solid waste management; local and global environmental challenges; climate change; sustainable cities; sustainable sources of energy, Introduction to the idea of sustainability and its relevance; environment-related legislation; Green Chemistry

Unit 2:

E-Waste and Green Computing:

E-waste Management: Sources, Legislation, Prevention, Control, Recent developments.
Waste due to Nano-materials and Micro-Plastics.
Green Computing: Green Computing, 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 & amp; Sons.
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.
4. M Afshar Alam, Sapna Jain, Hena Parveen, Green Computing Approach Towards Sustainable Development, Wiley Interscience Publications.

Reference Books:

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

Environmental Science Lab:

The students will learn to:
1. Apply the fundamental principles of measurement and skills in preparation and handling of Environmentally hazardous materials and interpret the statistical data related to measurements.
2. Use of the computational tools for searching, interpretation of results, etc. and preparation of case study regarding Environmental Issues.

List of Experiments:

Any Eight Experiments from the following:
[1] Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.

[2] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration in their various forms.
[3] Basic statistical analysis of results of neutralization of acid against the base and preparing acceptable graphs using software.
[4] Estimation of Copper ions from acid digested PCB solution.

[5] Estimation of Chromium ions from e-waste sample.
[6] Prediction of NMR spectra and analytical data of molecules using Computational Software and its analysis.
[7] Spectroscopic determine of wavelength of maximum absorption of chemical/biological compound in solution and plotting of calibration curves.
[8] Estimation of Fe (II) ions from e-waste rust spectrophotometrically / calorimetrically using 1,10-Phenanthroline method.
[9] 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.
[10] Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software
[11] Use of various open online search tools for Environmental Case Studies.

Suggested Books/Reference Books:

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

Suggested Reference Books:

(1) David Young, Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, Wiley Interscience Publications

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Course Code : 24HS01PR0202 **Course : Environmental Science Lab**

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

The students will learn to:
1. Apply the fundamental principles of measurement and skills in preparation and handling of Environmentally hazardous materials and interpret the statistical data related to measurements.
2. Use of the computational tools for searching, interpretation of results, etc. and preparation of case study regarding Environmental Issues.

List of Experiments:

Any Eight Experiments from the following:
[1] Demonstration of Handling of hazardous chemicals, MSDS (material safety data sheet), waste minimization strategies and chemical waste disposal.
[2] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration in their various forms.
[3] Basic statistical analysis of results of neutralization of acid against the base and preparing acceptable graphs using software.
[4] Estimation of Copper ions from acid digested PCB solution.
[5] Estimation of Chromium ions from e-waste sample.
[6] Prediction of NMR spectra and analytical data of molecules using Computational Software and its analysis.
[7] Spectroscopic determine of wavelength of maximum absorption of chemical/biological compound in solution and plotting of calibration curves.
[8] Estimation of Fe (II) ions from e-waste rust spectrophotometrically / calorimetrically using 1,10-Phenanthroline method.
[9] Determination of Free CO2 in the given water sample.
[10] Determination of dissolved oxygen (DO) in the given water sample.
[11] Estimation of Chlorine in water.
[12] Determination of rate of the reaction at room temperature and analysis of experimental data using Computational Software
[13] Determination of AQI of a region.
[14] Use of various open online search tools for Environmental Case Studies.

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.

Suggested Reference Books:

(1) David Young, Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, Wiley Interscience Publications

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Course Code : 24HS02PR0206 **Course : Liberal/Performing Arts**

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

Liberal/Performing arts basket

Sr. No.	Course Code	Course Name	Sem	Hours/week	Credits	Maximum marks	
						Learning Assessment 1	Learning Assessment 2
1	24HS02PR0206-01	Fundamentals of Indian Classical Dance: Bharatnatayam	I/II	2	1	25	25
2	24HS02PR0206-02	Fundamentals of Indian Classical Dance: Kathak	I/II	2	1	25	25
3	24HS02PR0206-03	Introduction to Digital Photography	I/II	2	1	25	25
4	24HS02PR0206-04	Introduction to Japanese Language and Culture	I/II	2	1	25	25
5	24HS02PR0206-05	Art of Theatre	I/II	2	1	25	25
6	24HS02PR0206-06	Introduction to French Language	I/II	2	1	25	25
7	24HS02PR0206-07	Introduction to Spanish Language	I/II	2	1	25	25
8	24HS02PR0206-08	Art of Painting	I/II	2	1	25	25
9	24HS02PR0206-09	Art of Drawing	I/II	2	1	25	25
10	24HS02PR0206-10	Nature camp	I/II	2	1	25	25
11	24HS02PR0206-11	Developing Self Awareness	I	2	1	25	25
12	24HS02PR0206-12	Art of Poetry	I	2	1	25	25
13	24HS02PR0206-13	Creative and Content Writing	I	2	1	25	25
14	24HS02PR0206-14	Science of Life through	I	2	1	25	25

		Bhagwad Gita					
15	24HS02PR0206-15	Sanskrit Sambhashan Spoken Sanskrit	I	2	1	25	25
16	24HS02PR0206-16	Kirtan Kala	I	2	1	25	25
17	24HS04PR0202-1	Adventure Sports	I	2	1	25	25
18	24HS04PR0202-2	Introduction to Defense Forces & Obstacle Training	I	2	1	25	25
19	24HS04PR0202-3	Self Defense and Indian Martial Arts	I	2	1	25	25
20	24HS04PR0202-4	Basic Nutritional Course	I	2	1	25	25

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Course Code: 24HS02PR0206-01 Course: Fundamentals of Indian Classical Dance: Bharatnatayam

L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1. Understand the importance of dance and Bharatnataym as an Indian dance form
2. Develop skills to perform the dance form at its basic level.
3. 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

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Syllabus for Semester II, B. Tech. Computer Science & Engineering
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Course Code: 24HS02PR0206-02 Course: Fundamentals of Indian Classical Dance: Kathak
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Understand the importance of dance and Kathak as an Indian dance form
2.Develop skills to perform the dance form at its basic level.
3.Evaluate their strengths and interest to take bridge course to give *Prarambhik* (1^{st} 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)

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-03 Course: Introduction to Digital Photography
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Develop an understanding of the technical aspects and aesthetics of Photography.
2.Apply the rules of digital photography for creating photographs.
3.Develop skills to enhance photographs through post processing.
4.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

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-04 Course: Introduction to Basic Japanese Language
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

Course objective

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

Course outcome

After the completion of the course the students will be able to achieve the following:
1. Basic understanding about Japan as a country and Japanese culture.
2.Ability to use vocabulary required for basic level communication in Japanese language.
3.Able to frame simple sentences in Japanese for everyday conversations

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: Basic day to day greetings in Japanese language and their usage through role-play
Practical-5: Practice sessions
Practical- 6: Communication Skills 2: framing sentences
Practical- 7: Practice sessions
Practical- 8: Introduction of Japanese Culture, Arts, Traditions, Etiquettes and Manners etc.

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)

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-05 Course: Art of Theatre
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Understand and synthesize the working of the prominent genres of theatre across the world.
2.Apply the skill of voice and speech in theatre and public speaking
3.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.
4.Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

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.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-06 Course: Introduction to French Language
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Demonstrate basic knowledge about France, the culture and similarities/differences between India and France
2.Learn to use simple language structures in everyday communication.
3.Develop ability to write in basic French about themselves and others.
4.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

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-07 Course: Introduction to Spanish Language
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France
2.Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic Spanish about themselves and others.
4.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

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-08 **Course: Art of Painting**
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

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:
1. Become familiar with the basic methods, techniques & tools of painting.
2.Train the eye and hand to develop sense of balance, proportion and rhythm.
3.Develop the ability to observe and render simple natural forms.
4.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

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-09 **Course: Art of Drawing**
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

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:
1.Become familiar with the basic methods, techniques & tools of drawing.
2.Train the eye and hand to develop sense of balance, proportion and rhythm.
3.Develop the ability to observe and render simple natural forms.
4.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

Syllabus for Semester II, B. Tech. Computer Science & Engineering
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Course Code: 24HS02PR0206-10 Course: Nature Camp
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

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:
1.Develop an affinity with nature by observing and understanding it marvels with guidance from experts
2. 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

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Course Code: 24HS02PR0206-11 **Course: Developing Self-awareness**
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

Course objectives:

The course aims to develop students in their personal as well as professional life by means of graphotherapy, NLP, and Neurobics

Course Outcomes:

On completion of the course, students will be able to achieve the following:
1.Gain foundational understanding of graphology and through self-analysis will achieve greater awareness about their strengths and weaknesses & areas for personal growth
2.students will be equipped with tools and techniques for continuous self-improvement, using signature analysis and graphotherapy as part of their personal development journey
3.understand how to use Neuro Linguistic Programming (NLP) strategies to set and achieve goals effectively, overcoming mental blocks and limiting beliefs.
4.Enhance ability to absorb, retain, and recall information, which can benefit academic and professional performance.

Syllabus:

Practical 1: The Power of Handwriting (Handwriting is Brainwriting)
Practical 2: Know yourself through handwriting
Practical 3: The Role of Signature in your life
Practical 4: Graphotherapy to enhance yourself in all ways
Practical 5: Neurolinguistic Programming , S.M.A.R.T Goal
Practical 6: Effective Communication Model, Rapport Building and Anchor
Practical 7: Brain Directives & Linguistic Presuppositions
Practical 8: Neurobics

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-12 **Course: Art of Poetry**
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

Course Outcomes:

To familiarize the students with the art of poetry and develop a sense of appreciation for the art

At the end of the course the student will be able to achieve the following:
1.Understand the origin and development of poetry
2.Appreciate the art of poetry in life
3.Develop aesthetic sense
4.Develop holistic perspective to their personality

Syllabus

Practical 1: Art of poetry – orientation
Practical 2: Forms of poetry – orientation
Practical 3: Forms of poetry – recitation
Practical 4: Application of poetry – orientation
Practical 5: Application of poetry – practical session
Practical 6: Poetry and aesthetics
Practical 7: Writing poetry – orientation
Practical 8: Writing poetry – writing sessions

Reading material

I. The Art of Poetry
1. Fry, S. (2005). The ode less travelled: Unlocking the poetic mind. HarperCollins.
2. Addonizio, K., & Laux, D. (1997). The poet's companion: A guide to the pleasures of writing poetry. W.W. Norton & Company.
3. Lucy, J. (Ed.). (2001). The art of poetry. Penguin Books.
II. Understanding and Interpretation of Poetry
1. Hirsch, E. (1999). How to read a poem: And fall in love with poetry. Harcourt Brace & Company.
2. Pinsky, R. (1998). The sounds of poetry: A brief history. Farrar, Straus and Giroux.
3. Meyer, M. (2005). Poetry: An introduction. Bedford/St. Martin's.
III. Writing Poetry
1. Hugo, R. (1979). The triggering town: Lectures and essays on poetry and writing. W.W. Norton & Company.
2. Bradbury, R. (1990). Zen in the art of writing: Releasing the creative genius within you. Bantam Books.
3. Behn, R., & Twichell, C. (Eds.). (1992). The practice of poetry: Writing exercises from poets who teach. HarperCollins.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-13 Course: Creative and content writing
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

Course objective:

The objective of the course is to equip students with comprehensive skills in creative and content writing through experiential learning and real-world applications.

Course outcomes:

On completion of the course, student will be able to achieve the following:
1.Understand and apply fundamental concepts and techniques of creative writing.
2.Apply storytelling techniques to create engaging narratives.
3.Develop and implement effective SEO and digital content strategies
4.Create and refine content using various tools and applying diverse writing styles and formats.
5.Utilize digital tools to craft multimedia narratives and create a professional portfolio.

Syllabus

Creative Writing
Practical 1: Introduction to Creative and Content Writing
Practical 2: Character and Story Development
Practical 3: Crafting Compelling Narratives

Content Writing
Practical 4: SEO and Digital Content Strategies
Practical 5: Writing for Media
Practical 6: Tools

Content Creation
Practical 7: Digital Storytelling
Practical 8: Creative Portfolio Launch

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-14 Course: Science of life through Bhagwad Gita
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week Total Credits: 01

Course Objective

The objective of the course is to seek directions from the Bhagwad Gita to garner life skills for a successful and happy life

Course Outcome

1.To understand the methodology to correctly interpret and analysis the scripture
2.To understand the application of various teaching of the Bhagwad Gita
3.Use meditation and breathing techniques for healthy mind and body.

Syllabus

Practical 1: Introduction to Bhagwad Gita - methodology
Practical 2: Real life application of chapter 1-3
Practical 3: Real life application of chapter 4-6
Practical 4: Real life application of chapter 7-9
Practical 5: Real life application of chapter 10-12
Practical 6: Real life application of chapter 13-15
Practical 7: Real life application of chapter 16-18
Practical 8: Meditation and breathing techniques

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS02PR0206-15 **Course: *Sanskrit Sambhashan- Spoken Sanskrit***
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

Course objectives:

The objective of the course is to enhance the communication skills of the students in Sanskrit

Course outcome

At the end of the course, the students will be able to achieve the following:
1.Enhanced writing skills in Sanskrit
2.Enhanced speaking skills in Sanskrit
3.Enhanced listening skills in Sanskrit
4.Enhanced writing skills in Sanskrit

Syllabus:

संस्कृतसम्भाषणशिबिरस्य पाठ्यक्रमः

प्रथमं दिनम्

- गीतम् - पठत संस्कृतम्.....।
- मम नाम -भवतः नाम किम्? भवत्याः नाम किम्? द्वयोः मध्ये परिचयः। परस्परं 5 जनान्।
- सः कः? सा का? तत् किम्?
- एषः, एषा, एतत्।
- अहम्, भवान्, भवती..... ...अभिनयः।
- आम्,न, वा/किम्.....अभिनयः।
- अस्ति × नास्ति.....अभिनयः।
- अत्र, तत्र, कुत्र, सर्वत्र, अन्यत्र, एकत्र - अभिनयः।
- षष्ठी - तस्य, एतस्य, कस्य, तस्याः, एतस्याः, कस्याः, मम, भवतः, भवत्याः.....अभिनयः।
  मम नासिका, भवतः नासिका, भवत्याः नासिका।
  एतत् कस्य? अङ्गानि प्रदर्श्य प्रश्नः।
- दशरथस्य..., सीतायाः..., लेखन्याः..., पुस्तकस्य...। स्फोरकपत्रस्य (Flash Card) उपयोगः करणीयः। 'पुत्रः' 'पतिः' इत्यादीनां वाक्यपत्राणाम् (Charts) उपयोगः करणीयः।
- गीतम् - मनसा सततं स्मरणीयम्।
- आवश्यकम्, मास्तु, पर्याप्तम्, धन्यवादः, स्वागतम्।
- पूर्वनिश्चितसम्भाषणप्रदर्शनम्।
- क्रियापदानां पाठनम् - गच्छति। आगच्छति। पठति। लिखति। खादति।पिबति। क्रीडति। वदति। उत्तिष्ठति। उपविशति।
- गच्छामि। आगच्छामि.....।
- गच्छतु। आगच्छतु.....।
- सङ्ख्याः - (अ) 1, 2, 3, 4,.....10। (आ) 10, 20, 30,.....100।
- समयः - 5.00, 5.15, 5.30, 4.45 ।
- कथा - गतानुगतिको लोकः। (काचित् कथा सरलया भाषया वक्तव्या)।
- रटनाभ्यासः (पूर्वमेव लिखितानि पठितानि च कानिचित् वाक्यानि वाचनीयानि)।
- एकं वाक्यम् (प्रत्येकं छात्रः एकं वाक्यं वदेत्।)
- सूचना।
- ऐक्यमत्यः।

द्वितीयं दिनम्

- गीतम्।
- पुनस्स्मारणम्।
- शब्देषु लिङ्गभेदज्ञापनम् - यथा -सः सुधाखण्डः, सा कुञ्चिका, तत् पुष्पम्।
- बहुवचनपाठनम् – बालकाः..., बालिकाः..., लेखन्यः..., पुस्तकानि...।
- ते, के, ताः, काः, तानि, कानि, एते, एताः, एतानि, भवन्तः, भवत्यः, वयम्। (चित्राणि उपयोक्तव्यानि।)
- वचनपरिवर्तनाभ्यासः। यथा - सः बालकः - ते बालकाः।
- अस्ति - सन्ति।
- कति?
- सप्तमी - हस्ते। उत्पीठिकायाम्। लेखन्याम्। पुस्तके। (स्फोरकपत्रस्य प्रयोगः करणीयः।) वाक्यपत्रस्य उपयोगेन वाक्यानि वाचनीयानि।
- कदा?
- उत्तराणां प्रश्नाः। (शिक्षकः आरम्भे उत्तरं वदेत्, अनन्तरं छात्राः तस्य प्रश्नं पृच्छेयुः।) यथा - रामः प्रातःकाले शालां गच्छति। रामः कदा शालां गच्छति?
- अद्य, श्वः, परश्वः, प्रपरश्वः, ह्यः, परह्यः, प्रपरह्यः, इदानीम्।
- गीतम्।
- गच्छन्ति। गच्छामः। गच्छन्तु।
- शिष्टाचारः - सुप्रभातम्/नमस्कारः/शुभरात्रिः/हरिः ओम्/क्षम्यताम्/चिन्ता मास्तु।
- प्रातर्विधिः - दन्तधावनम् इत्यादयः शब्दाः पाठनीयाः।
- सङ्ख्या - 1-50।
- समयः - 6.05, 6.10, 5.55, 5.50
- स्वागतसम्भाषणम्। (शिक्षकः सहशिक्षकेण सह कृत्वा प्रदर्शयेत्)
- कथा।
- रटनाभ्यासः।
- वाक्यद्वयम् (प्रत्येकम् अपि छात्रः वाक्यद्वयं वदेत्।)
- सूचनाः।
- ऐक्यमत्यः।

तृतीयं दिनम्

- गीतम्।
- पुनस्स्मारणम्।
- क्रियापदानां बहुवचनरूपाणि।
  गच्छन्ति - गच्छामः - गच्छन्तु (Chart दर्शनीयम्)
  पिबन्ति - पिबामः - पिबन्तु।
  लिखन्ति - लिखामः - लिखन्तु।
  इत्यादिपरिवर्तनाभ्यासः कारणीयः।
- द्वितीयाविभक्तिः - स्फोरकपत्राणाम् उपयोगः।
  (वाक्यपत्राणि उपयुज्य वाक्यानि वाचनीयानि।)
- कृपया ददातु - वस्तूनि प्रदर्श्य।
  शिक्षकः एकैकं वस्तु प्रदर्शयति।
  उदा. – ग्रन्थः, घटी,.....
  छात्राः - कृपया ग्रन्थं ददातु, कृपया घटीं ददातु इत्यादि वदेयुः। (स्फोरकपत्रस्य उपयोगः)
- पुरतः, पृष्ठतः, वामतः, दक्षिणतः, उपरि, अधः।
  (चित्रं दर्शनीयम्)
- इतः, ततः, ...तः, गृहतः, कुतः?
  (स्फोरकपत्राणाम् उपयोगः)
  वाक्यपत्राणि उपयुज्य वाक्यानि वाचनीयानि।
- गीतम्।
- कथम्? सम्यक्।
- शीघ्रम् × मन्दम्। उच्चैः × शनैः।
- पठनार्थम्, किमर्थम्?
- सप्तककाराः - किम्, कुत्र, कति, कदा, कुतः, कथम्, किमर्थम् (Chart प्रदर्शनीयम्)।
  एकैकम् उपयुज्य परस्परं प्रश्नाः।
- अपि।
- अस्तु।
- अहं न जानामि। - कानिचन वाक्यानि।
- भूतकालीनक्रियापदानां पाठनम्।
  गतवान् - पठितवान् - लिखितवान्।
  गतवती - पठितवती - लिखितवती।
- क्रियापदकोष्ठकस्य प्रथमपृष्ठस्य अभ्यासः।
- द्वितीयपृष्ठस्य सर्वाणि क्रियापदानि उपयुज्य छात्राः वर्तमानकाले वाक्यानि वदन्ति। (ए.व - ब.व.)
- विशिष्टक्रियापदानाम् अभ्यासः -
  करोमि - कुर्मः। करोति - कुर्वन्ति।
  ददामि - दद्मः। ददाति - ददति।
  शृणोमि – शृणुमः। शृणोति - शृण्वन्ति।
  जानामि – जानीमः। जानाति – जानन्ति।
- सम्बोधनम् - भोः !, श्रीमन् !, मान्ये !, भगिनि!, मित्र !, ...महोदय!, राम !, सीते ! इत्यादि।
- सङ्ख्या- 1-100।
- समयः - 1.00, 2.00, 3.00, 4.00।
- सम्भाषणप्रदर्शनम् (मित्रसंलापः)।
- कथा।
- वाक्यत्रयम् एकैकोऽपि छात्रः वदेत्।
- सूचना।
- ऐक्यमत्यः।

चतुर्थं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- च
- अतः
- एव
- इति
- अस्मि
- यदि -तर्हि
- यथा - तथा
- तः - पर्यन्तम् (वाक्यपत्रस्य उपयोगेन वाक्यानि वाचनीयानि।)
- अद्य आरभ्य
- कृते (वाक्यपत्रस्य उपयोगः करणीयः)
- क्तवतुप्रत्ययान्तानाम् अभ्यासः
  गतवान् - पठितवान् - लिखितवान् (ए.व. पुंलिङ्गे)।
  गतवती - पठितवती - लिखितवती (ए.व. स्त्रीलिङ्गे)।
  गतवन्तः - पठितवन्तः - लिखितवन्तः (ब.व. पुंलिङ्गे)।
  गतवत्यः - पठितवत्यः - लिखितवत्यः (ब.व. स्त्रीलिङ्गे)।
- सः गतवान् - सा गतवती - लिङ्गपरिवर्तनाभ्यासः।
- अहं गतवान् - अहं गतवती - लिङ्गपरिवर्तनाभ्यासः।
- क्रियापदानां कालपरिवर्तनाभ्यासः।
  यथा - गच्छति - गतवान्, गतवती।
- गीतम्।
- विशेषपाठनम् - आसीत्, आसन्, आसम्।
- एकः, एका, एकम् - लिङ्गभेदः ज्ञापनीयः।
  (स्फोरकपत्रस्य उपयोगः)

- भोजनसम्बन्धिशब्दाः यथा - सूपः, शाकम्, इत्यादयः।
- सङ्ख्या।
- समयः।
- ॐ – सङ्ख्याक्रीडा।
- कथा।
- सम्भाषणप्रदर्शनम्।
- चत्वारि वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

पञ्चमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- वाहनानां नामानि।
- तृतीयाविभक्तिः - दण्डेन, मापिकया, लेखन्या, पुष्पेण।
  (वाक्यपत्रस्य आधारेण वाक्यानि वाचनीयानि।)
- सह, विना।
- अद्यतन, ह्यस्तन, श्वस्तन, पूर्वतन, इदानीन्तन
- भविष्यत्कालीनक्रियापदानां पाठनम्।
  गमिष्यति, पठिष्यति, लेखिष्यति।(कोष्ठकस्य साहाय्येन)
- गत,आगामि।
- गीतम्।
- स्म।
- अभवत्।
- क्त्वाप्रयोगः (कोष्ठकस्य साहाय्येन)।
- यदा – तदा।
- बन्धुवाचकशब्दाः।
- वेशभूषणानां नामानि।
- वर्णाः।
- रुचयः।
- क्रीडा - एकश्वासेन सङ्ख्याकथनम्।
- कथा।
- पञ्च वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

षष्ठं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- नूतनम् x पुरातनम्,
- बहु x किञ्चित्,
- दीर्घः x ह्रस्वः।
- उन्नतः x वामनः।
- स्थूलः x कृशः।
- एतादृश, तादृश, कीदृश?
- तुमुन् (कोष्ठकस्य साहाय्येन)।
- किन्तु।
- निश्चयेन।
- बहुशः / प्रायशः।
- किल / खलु।
- शक्नोति।
- गीतम्।
- विशेषणविशेष्यभावस्य अभ्यासः।(प्रथमाविभक्तौ)
  सः उत्तमः बालकः।
  सा उत्तमा बालिका।
  तत् उत्तमं पुस्तकम्।
- इव। विनोदकणिका।(गतवान् 'इव' अभिनयं कृतवान्!)
- अपेक्षया।
- पशूनां नामानि।
- अवयवानां नामानि।
- वाक्यविस्तारणाभ्यासः।
  (सः मम पुस्तकं प्रातःकाले पञ्चवादने पठितवान्।)
- इतः पूर्वम् - इतः परम्।
- 'रामकृष्ण' सङ्ख्याक्रीडा।
- कथा।
- षट् वाक्यानि।
- सूचना।
- ऐक्यमत्यः।

सप्तमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- क्त्वा - तुमुन् - परिवर्तनाभ्यासः।
- बहिः x अन्तः।
- रिक्तम् x पूर्णम्।
- इतोऽपि।
- इत्युक्ते।
- अन्ते।
- चेत् - नो चेत्।

- गीतम्।
- आरोग्यसम्बन्धिशब्दाः – वैद्यरोगिसम्भाषणम्।
- प्रश्नोत्तरस्पर्धा।
- ऋषीणां नामानि।
- कथा - शिक्षकः एकां कथां वदति। अनन्तरं छात्रेषु एकैकः तस्याः कथायाः एकैकं वाक्यम् उक्त्वा कथां सम्पूर्णां करोति।
- सङ्ख्या - दीर्घसङ्ख्यापाठनम्।
- प्रश्नोत्तरम्।
- क्रीडा - (गणद्वये नामस्मरणक्रीडा)
- कथा।
- पुस्तकानां परिचयः।
- सप्त वाक्यानि।
- सूचना।
- ऐक्यमन्त्रः।

अष्टमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- वारम्।
- अतः - यतः परिवर्तनाभ्यासः।
- यद्यपि – तथापि।
- यत्र – तत्र।
- कति - कियत् - एतयोः भेदज्ञापनम्।
- यावत् – तावत्।
- यत् – तत्।
- यः - सः।
- या – सा।
- गीतम्।
- अस्माकम्।
- चर्चा।
- सङ्ख्या - 'शतायुः - गतायुः' क्रीडा।
- विनोदकणिकाकथनम्।
- कथा।
- अष्ट वाक्यानि।
- समाजनिधिविषये सूचना।
- ऐक्यमन्त्रः।

नवमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- चित्।
- ....द्वयम्।
- सङ्ख्यासु लिङ्गभेदः।
  एकः - एका - एकम्
  द्वयम् - द्वयम् - द्वयम्
  त्रयः - तिस्रः - त्रीणि
  चत्वारः - चतस्रः - चत्वारि
- शिश्रकः - अहं वैद्यः - मम नाम सुरेशः
  (छात्राः तमुद्दिश्य प्रश्नान् पृच्छेयुः।)
- ..... अर्थम् (समाजार्थम्, संस्कृतकार्यार्थम्...)।
- गीतम्।
- तव्यत् – अनीयर्।
- अनन्त्यकथारचना।
- सङ्ख्यान्वेषणम् (क्रीडा)।
- छात्रैः सह प्रश्नोत्तरम्।
- समाजनिधिविषये पुनःस्मारणम्।
- ऐक्यमन्त्रः।

दशमं दिनम्

- गीतम्।
- पुनःस्मारणम्।
- पत्रलेखनम्।
- दूरवाणीसम्भाषणम्।
- मार्गनिर्देशः – कुत्र गन्तव्यम् इत्यादि।
- तव्यत् अभ्यासार्थम् – अद्य किं किं करणीयम् ?
- सान्दर्भिकभाषणम् –
  1. प्रवासात् प्रतिनिवर्तनस्य।
  2. आपणिकस्य इत्यादि।
- क्रीडा – सङ्ख्यायोजनम् (गणद्वये)।
- शुभाशयाः।
- असत्यकथनम् / कल्पनाकथनम्।
- समारोपः (सर्वैः शिक्षार्थिभिः भारतमातुः पूजां कृत्वा निधिसमर्पणं करणीयम्।)
- पत्राचारप्रगतशिक्षणादिविषये सूचना।
- ऐक्यमन्त्रः।

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

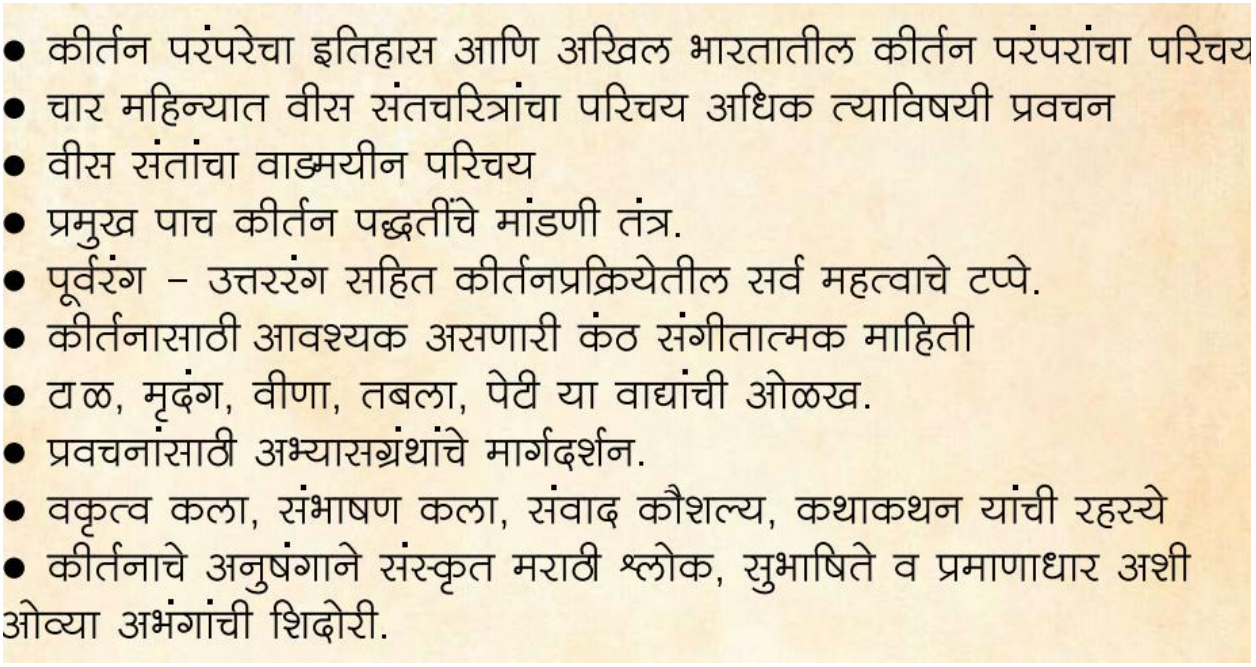
Course Code: 24HS02PR0206-16 **Course: *Kirtan Kala***
L: 00 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits: 01**

Course objectives:

The objective of the course is to provide the students with a spiritual experience as well as its benefits to them in the form of better abilities to concentrate and develop the ability to create a peaceful mind.

Course outcome

At the end of the course, the students will be able to achieve the following:
1.Learn from the inspiring spiritual journey of the saints and the history of Kirtan tradition
2.Learn about the musical instruments used in the art of Kirtan
3.Develop communication skills



Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS04PR0202-1 **Course Name: Adventure Sports**
L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 01**

Course Objective:

This course introduces adventure sports, emphasizing experiential learning through participation in various activities. The course will cover the fundamentals, safety procedures, and physical and mental benefits of adventure sports. Students will engage in outdoor activities such as wall climbing, rappelling, and more, fostering a connection with nature and understanding the principles of risk management.

Syllabus:

- Tent pitching, knot practice session and Tent allotment
- Activities like Jumaring and Climbing
- Individual challenge like Burma bridge, ladder bridge, multi vine
- Group Task like improvise raft making and Kayaking
- activities like Archery rifle shooting, cycle ride

Pattern of Classes: 2 Days and 1 Night Camp

Course Outcome:

By the end of this course, students will:

- Understand the principles and benefits of adventure sports.
- Develop basic skills in selected adventure sports.
- Learn and apply safety measures and risk management techniques.
- Foster teamwork, leadership, and problem-solving skills.
- Cultivate a greater appreciation for nature and outdoor activities.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS04PR0202-2 Course Name: Introduction to Defense Forces & Obstacle Training

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week Total Credits: 01

Course Objective:

1.Understand the Structure and Function of Defense Forces
2.Familiarize with Defense Force Training and Discipline
3.Learn Basic Obstacle Course Techniques
4.Apply Problem-Solving and Teamwork in Obstacle Training
5.Explore the Role of Obstacle Training in Defense Preparedness

Syllabus:

- Knot and Hitch practice session
- Activities like Rappelling & Wall Climbing
- Burma bridge & ladder bridge
- First Aid
- Rifle Shooting
- Horse riding
- Group Task and Team building activities

Pattern of Classes**:** 2 Days and 1 Night Camp

Course Outcome:

Upon successful completion of the course, students should be able to:
1.Describe the Structure and Functions of Defense Forces
2.Demonstrate Knowledge of Defense Training Protocols
3.Navigate Basic Obstacle Courses
4.Collaborate and Problem-Solve in Team-Based Exercises
5.Connect Obstacle Training to Defense Preparedness
6.Evaluate and Reflect on Training Experiences

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS04PR0202-3 **Course Name: Self Defense & Indian Martial Arts**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 01**

Course Objective:

This course provides students with practical knowledge and skills in self-defense, focusing on personal safety and awareness. Students will learn basic techniques for self-defense, including striking, blocking, and evasion, while also discussing the legal and ethical considerations of self-defense. The course will emphasize both physical techniques and mental preparedness.

Syllabus:

1. Mental Awareness
    - Importance of Self Defense
    - Types of Self Defense
    - Rules of Self Defense
2. Physical Session
    - Various Self Defense Techniques
    - Different Situational Defense Techniques
3. Improvise Weapon
    - Knowledge and practice of different equipment's which can be used for self defense
4. Martial Arts
    - Introduction of Indian Martial Arts
    - Demonstration of Indian Martial Arts
    - Training of Indian Martial Arts (Lathi Kathi)

Pattern of Classes: Training/Classes at Campus

Course Outcome:

By the end of this course, students will:
1.Understand the principles of personal safety and awareness.
2.Learn and practice basic self-defense techniques.
3.Develop strategies to avoid dangerous situations.
4.Understand the legal and ethical implications of using self-defense.
5.Build confidence and physical fitness through regular practice.

Syllabus for Semester II, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24HS04PR0202-4 **Course Name: Basic Nutritional Course**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 01**

Course Objective:

In the "Basics of Nutrition" course, students will develop a comprehensive understanding of essential nutrients and their roles in supporting overall health. They will learn to apply dietary guidelines effectively, tailoring recommendations to various age groups and health conditions. Additionally, students will cultivate the skills needed to assess and improve their own and others' eating habits for better health outcomes.

Syllabus:

Unit I

- Introduction to Nutrition – Define Balanced Diet, Nutrition, Optimum Nutrition, Nutrients, Concept of Health, Recommended Dietary Allowances (RDA)
- Carbohydrates (sources, functions and digestion)
- Proteins (sources, functions and digestion)
- Fats (sources, functions and digestion)
- Micronutrients (vitamins and minerals-sources, functions and digestion)

Practical I

- Display of all the foods with the help of students and while demonstrating teacher will again explain role and importance of nutrition in daily life. Deficiency will lead to chronic diseases and its prevention is very necessary for the quality of life.

Unit II

- What is Body Mass Index?
- What is Basal Metabolic Rate?
- What is Ideal Body Weight? (Male/Female)
- How to read labels on Food Packets?
- How to choose smart food and Concept of Rainbow diet, My Food Pyramid or My plate given by ICMR-NIN.

Practical II

- Calculation of Body Mass Index, Basal Metabolic Rate, Ideal Body Weight (Male/Female) with the use of self-body measurements.
- Demonstration of Rainbow diet, My Food Pyramid or My plate in a class.

Pattern of Classes:
Theory Classes – 10
Practical Classes – 2

Course Outcome:

By the end of the course, students will be able to accurately describe the functions of key nutrients and their impact on health, create balanced meal plans based on established dietary guidelines, and critically evaluate nutrition information to distinguish between credible and misleading sources.

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0301 **Course Name: Theory of Computation**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week **Total Credits: 03**

Course Objectives

1. This course aims to understand the basic theory of computation concepts that lies at the backbone of all state-of-the-art applications and program design.
2. Students can understand the capabilities and limitations of computation, as well as the specific applications and characteristics of deterministic and non-deterministic finite automata, context-free grammars, and ultimately, Turing machines.

Syllabus

UNIT-I: Basics of Theory of Computation, Basics of Sets and Relation, Countability and Diagonalization, Pigeon- hole principle. Fundamentals of formal languages and grammars, Chomsky hierarchy of languages.

UNIT-II: Finite Automata, Deterministic finite automata (DFA), Nondeterministic finite automata (NFA) and equivalence with DFA, Minimization of finite automata, NFA with Epsilon Transitions, Finite Automata with output.

UNIT-III: Regular expressions and Regular languages, Regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, Context-free grammars (CFG) and language (CFL), parse trees, ambiguity in CFG, Reduction of CFGs, Chomsky and Greibach normal forms.

UNIT-IV: Push Down Automata, Deterministic pushdown automata and non-deterministic pushdown automata, Acceptance by two methods: Empty stack and Final State, Equivalence of PDA with CFG, closure properties of CFLs.

UNIT-V: Turing Machines, The basic model for Turing machines (TM), Turing recognizable recursively enumerable) and Turing-decidable (recursive) languages, variants of Turing machines, unrestricted grammars and equivalence with Turing machines, and TMs as enumerators.

Course Outcomes:

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

1. Describe the formal relationships among machines, languages, and grammars.
2. Generate the finite automata for given regular languages.
3. Construct a Regular expression and the grammar for a given language.
4. Design Pushdown Automata, Turing Machine for given languages.

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Reference Books

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and the Theory of Computation, Tata McGraw Hill

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0302 **Course Name: Database Management System**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week **Total Credits: 03**

Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

SYLLABUS

UNIT-I Introduction to Database System
Concepts and Architecture Databases and Database Users, Characteristics of the Database Approach, Advantages of Using the DBMS Approach, When Not to Use a DBMS, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment.

UNIT-II The Relational Data Model and SQL
Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations, SQL Data Definition, Data Types and Constraints, Data Management in SQL, Transforming ER Model into Relational Model.

UNIT-III Database Design and Normalization
Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms.

UNIT IV Storage, Indexing, and Query Processing
Storage and File Organization, Indexing, Query Processing and Optimization, Ordered Indices, B+-Tree Index Files and its Extensions, Static Hashing and Dynamic Hashing, Bitmap Indices

UNIT V Transaction Processing, Concurrency Control and Recovery
Introduction to Transaction Processing, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Deadlock Handling and Multiple Granularity, Database Recovery Techniques.

Course Outcomes:

On completion of the course the student will be able to

1. Identify the basic concepts and various data model used in database design.
2. Recognize the use of normalization and functional dependency.
3. Understand the purpose of query processing and optimization.
4. Apply and relate the concept of transaction, concurrency control and recovery in database.

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; “Database System Concepts” Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; “Fundamentals of Database Systems”, Sixth Edition, Addison Wesley 2011.

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke; “Database Management Systems”; Third Edition; Tata McGraw Hill Publication, 2003.
2. C. J. Date; “Database in Depth – Relational Theory for Practitioners”; O`Reilly Media, 2005.

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0302 Course Name: Database Management System Lab

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week Total Credits: 01

Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

SYLLABUS

Based on the syllabus of 24CS02TH0302

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; "Database System Concepts" Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; "Fundamentals of Database Systems", Sixth Edition, Addison Wesley 2011.

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke; "Database Management Systems"; Third Edition; Tata McGraw Hill Publication, 2003.
2. C. J. Date; "Database in Depth – Relational Theory for Practitioners"; O`Reilly Media, 2005

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0303 Course Name: : Data Exploration and Visualization Lab

L: 0 Hrs. T: 0 Hrs. P: 4 Hrs. Per Week **Total Credits: 02**

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. Perform data extraction.
2. Understand and apply different data exploration, transformation and loading techniques.
3. Identify and apply appropriate data visualization technique(s).

Syllabus :

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

- Extract data from different sources like text files, APIs, databases.
- Data cleaning techniques
- Data processing techniques
- Data loading techniques
- Data visualization techniques like plots (line plot, scatter plot, etc), charts (bar charts, pie chart, donut chart, etc) , histograms, Box and Whisker Plot, Maps, Word Clouds, Network diagrams, Correlation Matrices, etc

Reference Books :

1. Claus O. Wilke, “Fundamentals of Data Visualization – A Primer on Making Informative and Compelling Figures”, O’Reilly, 2019.
2. Kyran Dale, “Data Visualization with Python and JavaScript – Scrape, Clean and transform Your Data”, O’Reilly, 2016.

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0304 **Course Name: : Network Communication**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week **Total Credits: 03**

Course Objectives

1. To understand communication Models OSI and TCP/IP models.
2. To provide understanding of signal transmission, encoding techniques, and the characteristics of transmission media.
3. To examine routing and transport layer protocols.
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, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division, and Wave division.

UNIT – II

Data Link Layer: Error Detection and Error Correction - Fundamentals, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ. Ethernet and Wi-Fi (IEEE 802.3, IEEE 802.11).

UNIT – III

Network Layer: Internet Protocol (IP) – Logical Addressing: IPV4, IPV6; Address mapping: ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.AI-Driven Adaptive Routing Protocols.

UNIT – IV

Transport Layer: Three-way handshaking, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), web Servers and Clients using Sockets (TCP/UDP), Congestion control in TCP, Application Layer: Domain Name Space (DNS), File Transfer Protocol (FTP).

UNIT V

IoT Communication Protocols: MQTT, CoAP. Evaluation of MQTT vs. CoAP for IoT Applications. ML-Based Traffic Prediction in Network Communication. Comparison of Wireless Protocols: Wi-Fi 6 vs. Wi-Fi 5.

Course Outcomes:

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

1. To demonstrate network models, protocols and apply data transmission principles.
2. To implement network routing and IP addressing
3. To Analyze flow control, congestion control, methods in transport layer protocols.
4. To develop and deploy a communication system with socket programming and communication Protocol for IoT devices.

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) Mic 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. “Fundamentals of IoT Communication Technologies” by Rolando Herrero (1st ed. 2022) , Springer Publisher.
4. Internet of Things, by Shriram K Vasudevan Abhishek S Nagarajan, RMD Sundaram. 2nd Edition, Wiley Publication.

Syllabus for Semester III, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0304 Course Name: : Network Communication Lab

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week Total Credits: 01

Course Objectives:

1. To implement different types of network topologies and configurations, ensuring scalability, reliability, and security.
2. To analyze common network protocols and communication technologies
3. To optimize the allocation of resources in networks and Simulate routing algorithm.

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

- Implementation on Simulation Tools: (CISCO PACKET TRACER).
- Implementation of Packet capture tool: Wireshark.
- Implementation of Data Link Layer (Error Correction).
- Design of Virtual LAN.
- Implementation of IP subnetting
- Routing Implementation at Network Layer.
- Implementation on Transport Layer.
- Application Server configuration on simulation Tools

Tools & Platforms to Use:

- Cisco Packet Tracer
- GNS3
- Wireshark
- Wi-Fi Analyzers (inSSIDer)
- Python & Netmiko for Network Automation
- VMWare/VirtualBox for Virtualized Labs
-

Course outcomes

1. To implement different network topologies, selecting the appropriate configuration based on the specific needs of a network.
2. To perform Troubleshooting for Network Devices
3. To Analyze Networking Protocols and write scripts to perform IP Addressing and Subnetting.
4. To implement server configuration using socket programming

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) Mic Graw Hill Publication.

Syllabus for Semester IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0401 Course Name: : Data Science and Programming

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week Total Credits: 03

Course Objectives

1. Understand the fundamentals of Data Science, its applications, and the role of programming in data analysis.
2. Learn Python programming concepts, including control structures, functions, and object-oriented programming for data processing.
3. Utilize Python data structures and libraries like NumPy and Pandas for efficient data handling and analysis.
4. Explore data visualization techniques using Matplotlib, Seaborn, and ggplot2 for insightful data representation.
5. Develop proficiency in R programming for data manipulation, statistical analysis, and basic machine learning applications.

Syllabus

UNIT I

Introduction: Overview of Data Science, Applications of Data Science in various domains, Data Science Lifecycle.
Introduction to Python: Control Structures, Functions and Modules, Python Programming Fundamentals: Conditions and Branching, Loops, Functions, Objects and Classes.

UNIT II

Python Data Structures: Lists and Tuples, Sets, Dictionaries, Strings Numpy: Array, Matrix and associated operations, Linear algebra and related operations

UNIT III

Introduction to Pandas: DataFrames and Series, Data Cleaning and Preprocessing, Handling missing values.
Data visualization: matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot

UNIT IV

Introduction to R and RStudio: Variables, Data Types, and Operators, Control Structures, Conditional statements (if-else), Loops (for, while), Functions and Packages in R
Data Handling in R: Vectors, Lists, Matrices, Data Frames, Importing and Exporting data (CSV, Excel, JSON)

UNIT V

Data Manipulation in R: dplyr: Filtering, Mutating, Grouping, Summarizing, tidyr: Data reshaping and cleaning.

Data Visualization using ggplot2: Histograms, Boxplots, Line Charts, Bar Plots.

Course Outcomes:

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

1. Describe the core concepts of Data Science, its real-world applications, and the fundamentals of Python and R programming environments.
2. Apply Python programming concepts, including control structures, functions, data structures, and NumPy for numerical computations.
3. Analyze and manipulate data using Pandas in Python and data handling functions in R.
4. Develop effective data visualizations using Matplotlib, Seaborn, and ggplot2 to interpret and present insights.
5. Evaluate and implement data preprocessing, transformation, and statistical operations using Python and R libraries for data-driven decision-making.

Text Books:

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by Wes McKinny, O'Reilly Media, 2012. ISBN 978-1-4493-1979-3
2. Data Science from Scratch: First Principles with Python, by Joel Grus, O'Reilly Media.
3. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, by Hadley Wickham & Garrett Grolemund, O'Reilly Media.

Syllabus for Semester IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0401 Course Name: : Data Science and Programming Lab

L: 0 Hrs. T: 0 Hrs. P: 4 Hrs. Per Week Total Credits: 02

Course Objectives

1. Understand the fundamentals of Data Science, its applications, and the role of programming in data analysis.
2. Learn Python programming concepts, including control structures, functions, and object-oriented programming for data processing.
3. Utilize Python data structures and libraries like NumPy and Pandas for efficient data handling and analysis.
4. Explore data visualization techniques using Matplotlib, Seaborn, and ggplot2 for insightful data representation.
5. Develop proficiency in R programming for data manipulation, statistical analysis, and basic machine learning applications.

Syllabus

Practical based on 24CS02TH0401

Course Outcomes:

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

1. Implement Python programming concepts, including control structures, functions, data structures, and NumPy for numerical computing.
2. Utilize Pandas for data manipulation, cleaning, and preprocessing in Python to handle structured datasets.
3. Apply R programming fundamentals, including data structures, control flow, and functions, for data handling and processing.
4. Perform data manipulation and visualization in R using dplyr, tidyr, and ggplot2 to derive meaningful insights.

Syllabus for Semester IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0402 Course Name: : Design and Analysis of Algorithms

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week **Total Credits: 03**

Course Objectives

The objective of this course is
1.To introduce students to techniques for effective problem solving in computing.
2.Developing skills to solve real life applications which involving algorithm development.
3.Making students capable of analyzing different paradigms and their complexities
4.To solve a given problem in efficient way.

Syllabus

Unit I
Mathematical foundations- Recurrence relations and their solutions, Complexity Calculation-Substitution Method, Recurrence tree method, Master Method, Asymptotic notations for analysis of algorithms, Amortized Analysis.

Unit II
Greedy method – Basic strategy, Minimum cost spanning trees- Prim's Algorithm, Kruskal's Algorithm, Fractional Knapsack Problem, Huffman Coding, Activity Selection Problem.

Unit III
Dynamic Programming - Basic strategy, Bellmen ford algorithm, All pairs shortest path, Multistage Graphs, Optimal Binary Search Trees, Traveling Salesman Problem, String Editing, Longest Common Subsequence problem and its variations.

Unit IV
Divide and Conquer- Basic strategy, Binary Search, Quick Sort, Merge sort, Maximum sub-array problem, Closest pair of points problem, Convex hull problem. Backtracking- Basic strategy, N-Queen's problem, Graph Coloring, Hamiltonian Cycles, Sum of Subset Problem.

Unit V
NP Theory: Non-Deterministic Algorithms, NP, NP-hard and NP-complete problems, Decision and Optimization problems, Graph based problems on NP Principle-vertex cover problem, clique cover problem, Independent Set Problem, Proving NP-completeness of various problems.

Course Outcomes

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

1. Comprehend the foundational principles involved in the design and analysis of algorithms.
2. Identify the algorithmic solution to solve a given problem.
3. Apply algorithmic techniques to solve real-life and complex computational problems.
4. Evaluate efficiency and complexity of various algorithms using mathematical analysis.

Text Books

1. Thomas H. Cormen et.al; “Introduction to Algorithms”; 3 Edition; Prentice Hall, 2009.
2. Horowitz, Sahani and Rajasekaram; “Computer Algorithms”, Silicon Press, 2008.
3. Sridhar S.; “Design and Analysis of Algorithms”, Oxford University Press.
4. Brassard and Bratley; “Fundamentals of Algorithms”, 1 Edition; Prentice Hall, 1995.

Reference Books

1. Parag Himanshu Dave, Balchandra Dave, “Design and Analysis of Algorithms” Pearson Education, O'relly publication.
2. Jon Kleinberg, Éva Tardos, “Algorithm design”, Pearson, 2005.
3. Richard Johnsonbaugh, “Algorithms”, Pearson Publication, 2003.

Course Code: 24CS02PR0402 Course Name: Design and Analysis of Algorithms Lab

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 01**

Course Objectives

The objective of the Design and Analysis of Algorithms Lab is to provide hands-on experience in implementing algorithmic techniques to solve computational problems efficiently. It aims to enhance students' skills in analyzing algorithm performance and applying suitable data structures and paradigms for optimization.

Syllabus

Experiments based on syllabus of Design and Analysis Algorithms Theory.

Course Outcomes

On successful completion of the course, students will be able to:
1. Implement various algorithm design techniques such as divide and conquer, greedy, dynamic programming, and backtracking in solving real-world problems.
2. Analyze the time and space complexity of algorithms implemented and compare their efficiency.
3. Apply appropriate data structures and algorithmic paradigms to develop optimized solutions.
4. Design and test solutions for computational problems using recursive and iterative approaches.

Text Books

1. Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
2. Algorithm Design" by Jon Kleinberg and Éva Tardos
Reference Books
1. Algorithms" by Robert Sedgewick and Kevin Wayne
2. The Design and Analysis of Computer Algorithms" by Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman.

Syllabus for Semester IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02TH0403 Course Name: : Artificial Intelligence

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per Week **Total Credits: 03**

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:

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 IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0403 Course Name: : Artificial Intelligence Lab

L: 0Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 01**

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:

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 IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]

Course Code: 24CS02PR0404 Course Name: : Community Engagement Project

L: 0Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 02**

Course Objectives

1.Develop an understanding of rural society, lifestyle, gender roles, social structures, and traditional values.
2.Analyze rural livelihoods, agriculture, water management, non-farm activities and economic challenges.
3.Explore governance structures, Panchayati Raj institutions, self-help groups, and local administrative mechanisms.
4.Engage in field visits, social audits, awareness programs, and problem-solving initiatives for rural development.

Syllabus:

Week 1-2:

Appreciation of Rural Society: Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.

Week 3-4:

Understanding rural and local economy and livelihood: Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour.

Week 5-8:

Rural and local Institutions: Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration.

Week 9-12:

Rural and National Development Programmes: History of various development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, SHRAM, Jal Jeevan Mission, SFURTI, Atma Nirbhar Bharat, etc.

Teaching/ Learning Methodology

- Visit Rural Schools / mid-day meal centres, study academic and infrastructural resources and gaps
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries

- Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the site
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem-solving measures
- Interaction with self-help groups women members, and study of their functions and challenges; planning for their skill building and livelihood activities
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP)
- Participate in Gram Sabha meetings, and study community participation
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
- Organize awareness programmes, health camps, Disability camps and cleanliness camps
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
- Formation of committees for common property resource management, village pond maintenance and fishing
- Classroom discussions, Group discussions, Field visit, Group presentation, Written assignment, Idea and project proposals for solving community issues

Course Outcomes

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

1. Understand the functioning of rural governance, Panchayati Raj, and self-help group initiatives and their impact on community welfare.
2. Gain applied knowledge of rural society, its social dynamics, and traditional community values.
3. Develop analytical skills to assess rural economies, livelihoods, and challenges faced by local communities.
4. Apply participatory approaches through fieldwork, social audits, and problem-solving for sustainable rural development.

Textbooks / Reference Books

1. Katar Singh, Anil Shishodia, Rural Development: Principles, Policies and Management, Fourth Edition, Atlantic Publishers and Distributors (P) Ltd, 2024, ISBN: 978-8126936786
2. Abhijit Guha, Nation-Building in Indian Anthropology: Beyond the Colonial Encounter, Routledge, Taylor & Francis, First Edition, 2022, ISBN: 978-1003341581
3. Surinder S. Jodhka, The Indian Village : Rural Lives in the 21st Century, Aleph Book Company; First Edition, 2023, ISBN: 978-9391047191
4. Parikshit Sahu, Rural Development in Modern India: Foundation and Pathways, Kaveri Books, 2021, ISBN: 978-9385719196
5. Manish Didwania, Sanjeev Prashar, Nitin Kishore Saxena, Rural Development & Management in India: Opportunities & Challenges (Countries and Cultures of the World), Nova Science Publishers Inc., 2017, ISBN: 978-1536118643
6. Jeet Ram Sharma, Leadership Dynamics in Panchayati Raj Institutions, IIP Iterative International Publishers, 2024, ISBN: 978-9357479585

Online Reference Course

1. https://onlinecourses.swayam2.ac.in/ugc23_ge04

Syllabus for Semester IV, B. Tech. Computer Science & Engineering
[Artificial Intelligence & Data Science]
Course Code:24CS02TH0405 Course Name: Creativity, Innovation & Design Thinking

L: 0Hrs. T: 0 Hrs. P: 2 Hrs. Per Week **Total Credits: 02**

Course Objectives

1.Develop a human-centred approach when designing, innovating, developing, and testing new products, services, and processes.
2.Understand the significance of innovation in the digital age and lead disruptive advancements.
3.Foster a culture of design thinking to encourage innovation within an organization.
4.Conceptualize and develop innovative solutions both individually and collaboratively to enhance business impact.
5.Develop the ability to design and evaluate prototypes that prioritize customer needs and drive innovation.

Syllabus

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

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

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

Unit IV
Innovation: Meaning and Importance — Difference with Creativity, Invention and Discovery Process, Nine lessons for Innovation, Design Thinking: Understanding the design thinking approach, Humancentered design, Case Studies on Innovation business ideas like Amazon, Swiggy, Red bus, Flip fart, Ola, Big Basket, methods and techniques —organizational Aspects, Economic Aspects like venture capital, angel investors, Evaluation of Effectiveness of Innovation

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

Course Outcomes:

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

Text Books and Reference Books

1. Design Thinking by Hasso Plattner, Christoph Meinel, Larry Leifer
2. The 7 Habits of Highly Effective People, by Stephen R. Covey
3. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
4. The art of Innovation, by Tom Kelley and the Deep Dive story