RAMDEOBABA UNIVERSITY
[RBU]
NAGPUR – 440013

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

PROGRAMME SCHEME
B. Tech Computer Science & Engineering
[Industry Integrated Program with SAP]

2025-26

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.

Program Education Objectives

1. To prepare graduates to apply the broad set of techniques, tools, and skills from science, mathematics and engineering required to solve problems in Computer Science and Engineering
2. To prepare graduates to address practices in computer science and engineering using software development life cycle principles.
3. To provide adequate training & opportunities to work as teams in multidisciplinary projects.
4. To prepare the graduates to exhibit professionalism, communication skills, ethical attitude, and practice their profession with high regard to legal and ethical responsibilities.
5. To prepare graduates for engaging in life-long learning, such as post graduate study & certification courses.

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.

Programme Specific Outcomes (PSOs)

1. **Foundation of Computer System:** Ability to understand fundamental concepts of computer science & engineering, operating system, networking& data organization systems, hardware & software aspects of computing.

2. **Software development Ability:** Ability to understand the software development life cycle. Possess professional skills and knowledge of software design process. Familiarity and algorithmic competence with a broad range of programming languages and open-source platforms.
3. **Research Ability:** Ability to apply knowledge base to identify research gaps in various domains, model real world problems, solve computational tasks, to provide solution for betterment of society with innovative ideas.

B. Tech. Computer Science and Engineering [2025-26]
Teaching & Evaluation Scheme [B. Tech CSE-SAP]

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: I (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering			Department		Computer Science and Engineering							Session	2025-26	
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)
							Mid Semester		End Semester		Teachers Assessment			
							45		75		30			
				L	P		Theory	Lab	Theory	Lab	Theory	Lab		
1	ESC	25CS01TP0101	Fundamentals of Programming	3	2	4	30	15	50	25	20	10	150	3 hrs
2	PCC	25EE01TH0108	Computer Architecture and Organization	3	0	3	30		50		20		100	3 hrs
3	ESC	25CS01PR0102	Fundamentals of Linux OS	0	2	1		15		25		10	50	
4	PCC	25CS06TP0103	Integrated Business Processes in Cloud ERP I	2	2	3	30	15	50	25	20	10	150	3 hrs
5	BSC	25HS03TP0109	Calculus and Linear Algebra	3	0	3	30		50		20		100	3 hrs
6	IKC/ VEC	25HS02TH0103 + 25HS02TH0104	Humanities Elective-I	1	0	1	30				20		50	
7	BSC/ CCA	25HS02PR0102+ 25HS02PR0105-1 to 17	Humanities Elective-II	0	2	1	15		25		10		50	
8	CCA	25HS04PR0105	Health-Fitness-Wellbeing	0	2	1		15		25		10	50	3 hrs
9	BSC	25HS05TP0102	Introduction to Quantum Computing	3	2	4	30	15	50	25	20	10	150	3 hrs
Total Courses		**9**		**Total Credits**			**21**		**Total Marks**				**850**	

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: II (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering			Department		Computer Science and Engineering							Session	2025-26	
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)	
				L	P		Mid Semester		End Semester		Teachers Assessment				
							45		75		30				
							Theory	Lab	Theory	Lab	Theory	Lab			
1	ESC	25CS01TP0201	Object Oriented Programming	3	2	4	30	15	50	25	20	10	150	3 hrs	
2	PCC	25CS01TP0202	Data Structures	3	2	4	30	15	50	25	20	10	150	3 hrs	
3	PCC	25CS01TP0203	Operating Systems	3	2	4	30	15	50	25	20	10	150	3 hrs	
4	VSEC	25CS01PR0204	Computer Workshop Lab	0	2	1		15		25		10	50		
5	PCC	25CS06TP0205	Integrated Business Processes in Cloud ERP II	3	2	3	30	15	50	25	20	10	150	2 hrs	
6	VEC	25HS01TP0205	Environmental Science	1	2	2	30	15		25	20	10	100		
7	IKC/ VEC	25HS02TH0203 + 25HS02TH0204	Humanities Elective-I	1	0	1	30				20		50		
8	BSC/ CCA	25HS02PR0202 + 25HS02PR0206-1 to 17	Humanities Elective-II	0	2	1		15		25		10	50		
Humanities Elective-I			25HS02TH0203	Foundational Course in Universal Human Values											
			25HS02TH0204	Foundational Literature of Indian Civilization											
Humanities Elective-II			25HS02PR0202	Professional Communication Lab											
			25HS02PR0206-1 to 17	Liberal/Performing Art											
Total Courses		8		Total Credits		21			Total Marks				**850**		

Liberal/ Performing Art Bucket

Sr. No.	Course Code	Course Title	L	P	Credits	Continuous Evaluation	End Sem Exam/ Internal Evaluation	Total	ESE Duration
1	25HS02PR0105-1/ 25HS02PR0206-1	Fundamentals of Indian Classical Dance: Bharatnatayam	0	2	1	25	25	50	--
2	25HS02PR0105-2/ 25HS02PR0206-2	Fundamentals of Indian Classical Dance: Kathak	0	2	1	25	25	50	--
3	25HS02PR0105-3/ 25HS02PR0206-3	Introduction to Digital Photography	0	2	1	25	25	50	--
4	25HS02PR0105-4/ 25HS02PR0206-4	Introduction to Basic Japanese Language	0	2	1	25	25	50	--
5	25HS02PR0105-5/ 25HS02PR0206-5	Art of Theatre	0	2	1	25	25	50	--
6	25HS02PR0105-6/ 25HS02PR0206-6	Introduction to French Language	0	2	1	25	25	50	--
7	25HS02PR0105-7/ 25HS02PR0206-7	Introduction to Spanish Language	0	2	1	25	25	50	--
8	25HS02PR0105-8/ 25HS02PR0206-8	Art of Painting	0	2	1	25	25	50	--
9	25HS02PR0105-9/ 25HS02PR0206-9	Art of Drawing	0	2	1	25	25	50	--
10	25HS02PR0105-10/25HS02PR0206-10	Nature Camp	0	2	1	25	25	50	--
11	25HS02PR0105-11/25HS02PR0206-11	Developing Self-awareness	0	2	1	25	25	50	--
12	25HS02PR0105-12/25HS02PR0206-12	Art of Poetry	0	2	1	25	25	50	--
13	25HS02PR0105-13/25HS02PR0206-13	Creative and content writing	0	2	1	25	25	50	--
14	25HS02PR0105-14/25HS02PR0206-14	Science of life through Bhagwad Gita	0	2	1	25	25	50	--
15	25HS02PR0105-15/25HS02PR0206-15	Sanskrit Sambhashan Spoken Sanskrit	0	2	1	25	25	50	--
16	25HS02PR0105-16/25HS02PR0206-16	Kirtan Kala	0	2	1	25	25	50	--
17	25HS02PR0107-17/25HS02PR0206-17	Introduction to German Language	0	2	1	25	25	50	--
18	25HS04PR0102-1/25HS04PR0202-1	Adventure Sports	0	2	1	25	25	50	--
19	25HS04PR0102-2/25HS04PR0202-2	Introduction to Defense Forces & Obstacle Training	0	2	1	25	25	50	--
20	25HS04PR0102-3/25HS04PR0202-3	First Aid & Disaster Management	0	2	1	25	25	50	--
21	25HS04PR0102-4/25HS04PR0202-4	Basic Nutritional Course	0	2	1	25	25	50	--
22	25HS04PR0102-5/25HS04PR0202-5	Stress Management Through Yoga & Meditation	0	2	1	25	25	50	--

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: III (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering			Department	Computer Science and Engineering							Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)
				L	P		Mid Semester		End Semester		Teachers Assessment			
							45		75		30			
							Theory	Lab	Theory	Lab	Theory	Lab		
1	PCC	25CS01TH0301	Theory of Computation	3	0	3	30		50		20		100	3 hrs
2	PCC	25CS01TP0302	Design and Analysis of Algorithms	3	2	4	30	15	50	25	20	10	150	3 hrs
3	PCC	25CS01TP0303	Computer Networks	3	2	4	30	15	50	25	20	10	150	3 hrs
4	PCC	25CS06TP0305	Basic ABAP Programming	1	2	2	30		50		20		100	3 hrs
5	PCC	25CS06TP0306	Intermediate ABAP Programming	3	2	4	30	15	50	25	20	10	150	3 hrs
6	VSEC	25CS01PR0304	Software Laboratory–I	0	4	2		15		25		10	50	
7	OE	25CSOEC01TH0305	Open Elective-I	2	0	2	30		50		20		100	2 hrs
Total Courses		**7**		**Total Credits**		**21**			**Total Marks**				**750**	

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: IV (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering			Department		Computer Science and Engineering						Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)	
				L	P		Mid Semester		End Semester		Teachers Assessment				
							45		75		30				
							Theory	Lab	**Theory**	**Lab**	Theory	Lab			
1	PCC	25CS01TH0401	Compiler Design	3	0	3	30		50		20		100	3 hrs	
2	PCC	25CS01TP0402	Database Management System	3	2	4	30	15	50	25	20	10	150	3 hrs	
3	PCC	25CS01TP0403	Artificial Intelligence	3	2	4	30	15	50	25	20	10	150	3 hrs	
4	PEC	25CS01PR0404	Software Laboratory–II	0	4	2		15		25		10	50		
5	PCC	25CS06TP0405	Advanced ABAP Programming	3	2	4	30	15	50	25	20	10	150	3 hrs	
6	OE	25CSOEC01TH0405	Open Elective-II	2	0	2	30		50		20		100	2 hrs	
7	CEP	25CS01PR0405	Community Engagement Project	0	4	2		15		25		10	50		
8	VEC	25CS06PR0406	Creativity, Innovation & Design Thinking	1	0	1		30				20	50		
9	AEC	25CS01PR0407	Basic Competitive Coding	0	2	1		30				20	50		
Total Courses		**9**		**Total Credits**		**23**			**Total Marks**				**800**		

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: V (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering				Department	Computer Science and Engineering						Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)
				L	P		Mid Semester		End Semester		Teachers Assessment			
							45		75		30			
							Theory	Lab	Theory	Lab	Theory	Lab		
1	PCC	25CS01TP0501	Machine Learning	3	2	4	30	15	50	25	20	10	150	3 hrs
2	PCC	25CS01TH0502	Software Engineering	3	0	3	30		50		20		100	3 hrs
3	PCC	25CS01TP0503	Cloud Computing	3	2	4	30	15	50	25	20	10	150	3 hrs
4	PCC	25CS06TP0503	Fiori Programming I	4	2	5	30	15	50	25	20	10	150	3 hrs
5	PCC	25CS01PR0505	Design Patterns Lab	0	4	2		15		25		10	50	
6	PEC	25CS01TH0506	Program Elective-I	3	0	3	30		50		20		100	3 hrs
7	OE	25CSOEC01TH0505	Open Elective-III	2	0	2	30		50		20		100	2 hrs
Total Courses		**7**		**Total Credits**		**23**			**Total Marks**				**850**	

RAMDEOBABA UNIVERSITY, NAGPUR-13														
Semester: VI (B. Tech in Computer Science and Engineering [SAP])														
School	Computer Science and Engineering			Department	Computer Science and Engineering						Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)
				L	P		Mid Semester		End Semester		Teachers Assessment			
							45		75		30			
							Theory	Lab	Theory	Lab	Theory	Lab		
1	PCC	25CS01TP0601	Deep Learning-I	3	2	4	30	15	50	25	20	10	150	3 hrs
2	PEC	25CS01TP0602	Generative AI	3	2	4	30	15	50	25	20	10	150	3 hrs
3	PEC	25CS01TH0603	Program Elective –II	3	0	3	30		50		20		100	3 hrs
4	PEC	25CS01TP0604	Program Elective –III	3	0	3	30		50		20		100	3 hrs
5	PCC	25CS01PR0605	Comprehensive Viva	0	2	1		30				20	50	
6	AEC	25HS02TP0601	Business Communication	1	2	2	30	15		25	20	10	100	
7	VSEC	25CS01PR0605	Mini Project	0	4	2		15		25		10	50	
8	AEC	25CS01PR0606	Advanced Competitive Coding	0	2	1		30				20	50	
9	PCC	25CS06TP0608	Fiori Programming II	3	2	3	30		50		20		100	3 hrs
Total Courses		**8**		**Total Credits**		**23**			**Total Marks**				**850**	

RAMDEOBABA UNIVERSITY, NAGPUR-13															
Semester: VII (B. Tech in Computer Science and Engineering [SAP])															
School	Computer Science and Engineering				Department	Computer Science and Engineering						Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)
							Mid Semester		End Semester		Teachers Assessment			
							45		75		30			
				L	P		Theory	Lab	Theory	Lab	Theory	Lab		
1	PCC	25CS01TP0701	Deep Learning-II	3	2	4	30	15	50	25	20	10	150	3 hrs
2	PEC	25CS01TP0702	Program Elective-IV	3	0	3	30		50		20		100	3 hrs
3	PCC	25CS01TP0703	Data Mining & Analytics	2	2	3	30	15	50	25	20	10	150	3 hrs
4	Internship	25CS01PR0707	Internship and Project Work	-	16	8	30		50		20		100	
Total Courses		**4**		**Total Credits**		**18**			**Total Marks**				**500**	

RAMDEOBABA UNIVERSITY, NAGPUR-13																
Semester: VIII (B. Tech in Computer Science and Engineering [SAP])																
School	Computer Science and Engineering				Department	Computer Science and Engineering							Session	2025-26		
S. No	Course Type	Course Code	Course Name	Hours/Week		Credits	Maximum Marks						Total	ESE Duration (Hrs)		
				L	P		Mid Semester		End Semester		Teachers Assessment					
							45		75		30					
							Theory	Lab	Theory	Lab	Theory	Lab				
1	PRJ	25CS01PR0803	Internship and Project Work	0	24	12		60		100		40	200			
Total Courses		1		**Total Credits**		**12**			**Total Marks**				**200**			

	CSE		SAP	
Semester	**Subject**	**Credits**	**Subject**	**Credits**
Semester I	Cyber Laws & Ethics in IT	2	Integrated Business Processes in Cloud ERP I	3
	Computer Workshop-I	1		
	Probability and Statistics	3	Calculus & Linear Algebra	4
Semester II	Calculus and Linear Algebra	3	Integrated Business Processes in Cloud ERP II	3
Semester III	Discrete Mathematics	3	Basic ABAP Programming	2
	MDM - I	3	Intermediate ABAP Programming	4
Semester IV	MDM-II	3	Advanced ABAP Programming	4
	Software Lab-II	1		
Semester V	Software Lab-III	2	Fiori Programming	5
	MDM-III	3		
	Idea Lab	1	Design Pattern Lab	2
	Software Engineering Lab	1		
Semester VI	Program Elective-II	4	Generative AI	4
	MDM-IV	3	Fiori Programming II	3
Semester VII	Program Elective-V	4	Deep Learning II	4
	Program Elective-VI	3	Program Elective-IV	3
	Program Elective-VII	3	Data Mining & Analytics	3
	Program Elective-VIII	3	Internship & Project	8
	Major Project-1	4		
	Participative Learning	1		

Elective Basket

Micro Specialization	Elective-I [V Sem]	Elective-II [VI Sem]	Elective-III [VI Sem]	Elective-IV [VII Sem]
Cloud	Distributed and Parallel Databases	Administration Cloud	Development on Cloud	AI & ML on Public Cloud Platform [Preparation for AI 900 Certification]
Security	Intrusion Detection and Prevention System	Ethical Hacking	Vulnerability Assessment and Penetration Testing	Cyber Risk Assessment & Management
Image processing and NLP	Computer Graphics	Digital Image Processing	Natural Language Processing	Computer Vision
General	E-Commerce & ERP	Customer Relationship Management	System Design	Fog Computing

Additional courses offered by School of CSE

Honors Programs

Honors in Web Technologies

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	III	25CS05HT0301	Blockchain and Web 3 Programming	3	0	3	100	-	100	-
2	IV	25CS05HT0401	Development of Progressive Web Application	3	0	3	100	-	100	-
3	V	25CS05HT0501	Cloud Native App Development	4	0	4	100	-	100	-
4	VI	25CS05HT0601	Introduction to Devops	4	0	4	100	-	100	-
5	VII	25CS05HP0701	Project	0	8	4	50	50	100	-

Honors in Full Stack Development

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	III	25CS01HT0301	Web Development	3	0	3	100	-	100	-
2	IV	25CS01HT0401	Full Stack-I	3	0	3	100	-	100	-
3	V	25CS01HT0501	Full Stack-II	4	0	4	100	-	100	-
4	VI	25CS01HT0601	Software Development Automation	4	0	4	100	-	100	-
5	VII	25CS01HP0701	Project	0	8	4	50	50	100	-

Honors in Cyber Security

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	III	25CS04HT0301	Information and Cyber Security	3	0	3	100	-	100	-
2	IV	25CS04HT0401	Cyber Security Auditing	3	0	3	100	-	100	-
3	V	25CS04HT0501	Cyber Forensics: Threats, Vulnerability, Malware	4	0	4	100	-	100	-
4	VI	25CS04HT0601	Security Strategies in Windows and Linux	4	0	4	100	-	100	-
5	VII	25CS04HP0701	Project	0	8	4	50	50	100	-

Honors in Data Science

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	III	25CS02HT0301	Data Science Essentials	3	0	3	100	-	100	-
2	IV	25CS02HT0401	Software Architecture Analysis	3	0	3	100	-	100	-
3	V	25CS02HT0501	Data Engineering	4	0	4	100	-	100	-
4	VI	25CS02HT0601	Business and Web Analytics	4	0	4	100	-	100	-
5	VII	25CS02HP0701	Project	0	8	4	50	50	100	-

Honors in AIML

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	III	25CS03HT0301	Computational Statistics for Data Science	3	0	3	100	-	100	-
2	IV	25CS03HT0401	Distributed Computing Frameworks	3	0	3	100	-	100	-
3	V	25CS03HT0501	AIML Techniques for Vision and Navigation	4	0	4	100	-	100	-
4	VI	25CS03HT0601	Generative Adversarial Networks	4	0	4	100	-	100	-
5	VII	25CS03HP0701	Project	0	8	4	50	50	100	-

Honors With Research

Sr No	Sem	Course Code	Course Name	Hours/ Week			Maximum Marks			ESE Durations on
				L	P	Credits	Continuous Evaluation	End Sem Exam	Total	
1	VII	25CS01HT0701	Research Methodology/ NPTEL	4	0	4	50	50	100	-
2	VII	25CS01HP0702	Project -I	0	8	4	100	100	200	-
3	VIII	25CS01HP0801	Project -II	0	20	10	200	200	400	-

Minor Program

Semester	Course Name	Course Code
III	Programming for Problem Solving	25CS01MT0301
IV	Tools & Techniques of Artificial Intelligence	25CS01MT0401
V	Exploratory Data Analysis	25CS01MT0501
VI	Fundamentals of Machine Learning	25CS01MT0601
VII	Project	25CS01MP0701

Multidisciplinary Minor [MDM] Track
[For Students other than School of Computer Science & Engineering]

MDM Course Name [CSE]	Semester	MDM	Course Code
Introduction to Web Development	III	MDM-I	25CS01TH0305
Front End Development	IV	MDM-II	25CS01TH0407
Backend Technologies	V	MDM-III	25CS01TH0507
Cloud Technologies	VI	MDM-IV	25CS01TH0605

Exit Programs Options

First Year [Certificate Course in Basic Programming Skills]

i. Computer Hardware and Networking
ii. Advanced JAVA programming
iii. Python Programming
iv. Web Designing

Second Year [Diploma in respective discipline]

i. Web Development
ii. Mobile Development
iii. Data Analyst
iv. Ethical Hacking
v. IT certified data engineer
vi. Blockchain and its application

Third Year [Bachelor of Vocation in respective discipline]

i. Project

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

Course Code: 25CS01TP0101 **Course: Fundamentals of Programming**

L: 3Hrs, P: 2Hr, Per Week **Total Credits: 4**

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

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

Syllabus for Semester I, B. Tech. Computer Science & Engineering [SAP]
Course Code: 25EE01TH0108 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 [SAP]

Course Code: 25CS01PR0102 **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 [SAP]

Course Code: 25CS06TP0103 Course: Integrated Business Processes in Cloud ERP I

L: 2 Hrs, P: 2 Hr, Per Week Total Credits: 3

- SAP S/4HANA Overview
- New User Experience: SAP Fiori UX
- System-wide concepts
- Record to Report Processing: Financial Accounting and Management Accounting
- Hire to Retire Processing in SAP S/4HANA
- Source to Pay Processing in SAP S/4HANA

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

Course Code: 25HS03TH0109 Course: Calculus & Linear Algebra

L: 3 Hrs., P: 0 Hrs., 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: (8 Lectures)

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: (10 Lectures)

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: (8 Lectures)

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: (8 Lectures)

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: (6 Lectures)

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

Textbooks/References

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

Syllabus for Semester I/II, B. Tech. Computer Science & Engineering [SAP]

Course Code :25HS02TH0103 **Course: Foundation course in Universal Human**

25HS02TH0203 **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 **5 hours**

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 **4 hours**

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

Unit 3: - Relationships and Society **5 hours**

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. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Syllabus for Semester I/II, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25HS02TH0104 **Course: Foundational Literature of Indian**

25HS02TH0204 **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 an 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 I, B. Tech. Computer Science & Engineering [SAP]

Course Code :25HS04PR0105 **Course: Health-Fitness-Wellbeing**

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.

Course Content:

Unit 1:

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

Unit 2:

- Yoga: Standing, Sitting, Prone & Supine positions.
- Suryanamaskar.
- Pranayama, Meditation and Relaxation Techniques.
- Recreational Games.
- Practice of Fundamental Skills of Basketball, Football, Carrom, etc.
- 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 I, B. Tech. Computer Science & Engineering [SAP]

Course Code:25HS05TP0102 **Course: Introduction to Quantum Computing**

L: 3 Hrs, P: 2Hr, Per Week **Total Credits: 4**

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 Quantum computation and quantum information, Michael A. Nielsen and Isaac Chuang, Cambridge University Press 2010

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

Course Code: 25HS02PR0208 **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:

CO1: Implement essential language skills- listening, speaking, reading, and writing
CO2: Demonstrate the techniques of effective Presentation Skills
CO3: Evaluate and apply the effective strategies for Group Discussions and Personal Interviews
CO4: 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.

Course Code: 25HS02PR0206-1-17 **Course: Liberal/Performing arts**
L: 0 Hr, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits:1**

Liberal/Performing arts basket

Sr. No.	Course Code	Course Title	L	P	Credits	Continuous Evaluation	End Sem Exam/ Internal Evaluation	Total	ESE Duration
1	25HS02PR0206-1	Fundamentals of Indian Classical Dance: Bharatnatayam	0	2	1	25	25	50	NA
2	25HS02PR0206-2	Fundamentals of Indian Classical Dance: Kathak	0	2	1	25	25	50	NA
3	25HS02PR0206-3	Introduction to Digital Photography	0	2	1	25	25	50	NA
154	25HS02PR0206-4	Introduction to Basic Japanese Language	0	2	1	25	25	50	NA
5	25HS02PR0206-5	Art of Theatre	0	2	1	25	25	50	NA
6	25HS02PR0206-6	Introduction to French Language	0	2	1	25	25	50	NA
7	25HS02PR0206-7	Introduction to Spanish Language	0	2	1	25	25	50	NA
8	25HS02PR0206-8	Art of Painting	0	2	1	25	25	50	NA
9	25HS02PR0206-9	Art of Drawing	0	2	1	25	25	50	NA
10	25HS02PR0206-10	Nature Camp	0	2	1	25	25	50	NA
11	25HS02PR0206-11	Developing Self-awareness	0	2	1	25	25	50	NA
12	25HS02PR0206-12	Art of Poetry	0	2	1	25	25	50	NA
13	25HS02PR0206-13	Creative and content writing	0	2	1	25	25	50	NA
14	25HS02PR0206-14	Science of life through Bhagwad Gita	0	2	1	25	25	50	NA
15	25HS02PR0206-15	Sanskrit Sambhashan Spoken Sanskrit	0	2	1	25	25	50	NA
16	25HS02PR0206-16	Kirtan Kala	0	2	1	25	25	50	NA
17	25HS02PR0206-17	Introduction to German Language	0	2	1	25	25	50	NA
18	25HS04PR0202-1	Adventure Sports	0	2	1	25	25	50	NA
19	25HS04PR0202-2	Introduction to Défense Forces & Obstacle Training	0	2	1	25	25	50	NA

20	25HS04PR0202-3	First Aid & Disaster Management	0	2	1	25	25	50	NA
21	25HS04PR0202-4	Basic Nutritional Course	0	2	1	25	25	50	NA
22	25HS04PR0202-5	Stress Management Through Yoga & Meditation	0	2	1	25	25	50	NA

Syllabus for Semester I/II, B. TECH Computer Science & Engineering [SAP]

Course Code: 25HS02PR0105-1 Course: Fundamentals of Indian Classical Dance: 25HS02PR0206-1 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 Bharatanatyam, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self- confidence, creativity, focus, coordination, etc.

Course Outcomes

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

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

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

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

Syllabus

Practical -1: Orientation in Bharatanatyam

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

Syllabus for Semester I/II, B. TECH Computer Science & Engineering [SAP]

Course Code: 25HS02PR016-02 Course: Fundamentals of Indian Classical Dance: Kathak

25HS02PR0206-02

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:

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

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

CO3: Evaluate their strengths and interest to take bridge course to give *Prarambhik* (1st level formal examof 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 I/II, B. TECH Computer Science & Engineering [SAP]

Course Code: 25HS02PR0105-3 **Course: Introduction to Digital Photography**
25HS02PR0206-3

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:

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

Syllabus

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

Practical 8: Portfolio finalization and presentation in selected genre.

Reference material

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

Syllabus for Semester I/II, B. TECH Computer Science & Engineering [SAP]

Course Code:25HS02PR0105-4 **Course: Introduction to Basic Japanese**
25HS02PR0206-4 **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: CO1: Basic understanding about Japan as a country and Japanese culture.
CO2: Ability to use vocabulary required for basic level communication in Japanese language. CO3: 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 I/II, B. TECH Computer Science & Engineering [SAP]

Course Code: 25HS02PR0105-5 **Course: Art of Theatre**
25HS02PR0206-5

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:

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

Syllabus:

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 I/II, B. TECH Computer Science & Engineering [SAP]

Course Code: 25HS02PR0105-6 **Course: Introduction to French**

25HS02PR0206-6

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:

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

CO2. Learn to use simple language structures in everyday communication. CO3. Develop ability to write in basic French about themselves and others. CO4. Develop ability to understand beginner level texts in French

Syllabus

List of Practical's

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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS02PR0105-7 **Course: Introduction to Spanish**
254HS02PR0206-7 **Language**
L: 00 Hrs, 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.

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

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

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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS02PR0105-8 **Course: Art of Painting**
25HS02PR0206-8
L: 00 Hrs, 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.

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)

Course outcome:

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

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

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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS02PR0105-9 **Course: Art of Drawing**
25HS02PR0206-9

L: 00 Hrs, 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.

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

Course outcome:

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

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

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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS02PR0105-10 **Course: Nature Camp**
25HS02PR0206-10

L: 00 Hrs, 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 content

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

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

Course outcome:

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

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

Course Code: 25HS02PR0105-11 **Course: Developing Self-awareness**
25HS02PR0206-11
L: 00 Hrs, 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

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**

Course Outcomes:

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

CO1: Gain foundational understanding of graphology and through self-analysis will achieve greater awareness about their strengths and weaknesses & areas for personal growth
CO2: students will be equipped with tools and techniques for continuous self-improvement, using signature analysis and graphotherapy as part of their personal development journey
CO3: understand how to use Neuro Linguistic Programming (NLP) strategies to set and achieve goals effectively, overcoming mental blocks and limiting beliefs.
CO4: Enhance ability to absorb, retain, and recall information, which can benefit academic and professional performance.

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

Course Code: 25HS02PR0105-12 **Course: Art of Poetry**
25HS02PR0206-12

L: 00 Hrs, P: 2 Hrs, Per Week **Total Credits: 01**

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**

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:

CO1: Understand the origin and development of poetry
CO2: Appreciate the art of poetry in life
CO3: Develop aesthetic sense
CO4: Develop holistic perspective to their personality

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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS02PR0105-13 **Course: Creative and content writing**
25HS02PR0206-13

L: 00 Hrs, 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.

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**

Course outcomes:

On completion of the course, student will be able to achieve the following:
CO1: Understand and apply fundamental concepts and techniques of creative writing.
CO2: Apply storytelling techniques to create engaging narratives.
CO3: Develop and implement effective SEO and digital content strategies
CO4: Create and refine content using various tools and applying diverse writing styles and formats.
CO5: Utilize digital tools to craft multimedia narratives and create a professional portfolio.

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

Course Code: 25HS02PR0105-14 Course: Science of life through Bhagwad Gita
25HS02PR0206-14

L: 00 Hrs, 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

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**

Course Outcome

CO1: To understand the methodology to correctly interpret and analysis the scripture
CO2: To understand the application of various teaching of the Bhagwad Gita
CO3: Use meditation and breathing techniques for healthy mind and body.

Syllabus for Semester I/II, B. TECH Computer Science & Engineering
Course Code: 25HS02PR0105-15 Course: Sanskrit Sambhashan- Spoken Sanskrit 25HS02PR0206-15
L: 00 Hrs, 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

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।
- ऐक्यमन्त्रः।

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 (कोष्टकस्य 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।
- अन्तो।
- 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।

Course outcome

At the end of the course, the students will be able to achieve the following:
CO1: Enhanced writing skills in Sanskrit
CO2: Enhanced speaking skills in Sanskrit
CO3: Enhanced listening skills in Sanskrit
CO4: Enhanced writing skills in Sanskrit

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

Course Code: 25HS02PR0105-16 **Course: Kirtan Kala**

25HS02PR0206-16

L: 00 Hrs, 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.

- कीर्तन परंपरेचा इतिहास आणि अखिल भारतातील कीर्तन परंपरांचा परिचय
- चार महिन्यात वीस संतचरित्रांचा परिचय अधिक त्याविषयी प्रवचन
- वीस संतांचा वाङ्मयीन परिचय
- प्रमुख पाच कीर्तन पद्धतींचे मांडणी तंत्र.
- पूर्वरंग – उत्तररंग सहित कीर्तनप्रक्रियेतील सर्व महत्वाचे टप्पे.
- कीर्तनासाठी आवश्यक असणारी कंठ संगीतात्मक माहिती
- टाळ, मृदंग, वीणा, तबला, पेटी या वाद्यांची ओळख.
- प्रवचनांसाठी अभ्यासग्रंथांचे मार्गदर्शन.
- वकृत्व कला, संभाषण कला, संवाद कौशल्य, कथाकथन यांची रहस्ये
- कीर्तनाचे अनुषंगाने संस्कृत मराठी श्लोक, सुभाषिते व प्रमाणाधार अशी ओव्या अभंगांची शिदोरी.

Course outcome

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

CO1: Learn from the inspiring spiritual journey of the saints and the history of Kirtan tradition

CO2: Learn about the musical instruments used in the art of Kirtan

CO3: Develop communication skills

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

Course Code: 25HS02PR0105-17 **Course: Introduction to German Language**
25HS02PR0206-17

L: 00 Hrs, P: 2 Hrs, Per Week **Total Credits: 01**

Course objective:

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

List of Practicals

Practical-1: Orientation about Germany, the language, and culture
Practical-2: Vocabulary building for everyday conversations
Practical -3: Numbers, days and time
Practical-4: Introducing Oneself & Others
Practical-5: Reading Skills: Reading simple text in German language
Practical-6: Basic Verbs & Sentence Construction
Practical-7: Food & Dining, Giving Directions & Transportation
Practical-8: Writing Skills: Write basic German and practice

Course outcomes:

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

1. Demonstrate basic knowledge about Germany, the culture and similarities/differences between India and Germany
2. Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic German about themselves and others.
4. Develop ability to read and understand beginner level texts in German.

Recommended reading

1. German Made Easy by Diego A. Agundez
2. Teach Yourself Complete German: Learn to Read, write, Speak and Understand A new Language by Paul Coggle, Heiner Schenke
3. Netzwerk A1 by Helen Smitz, Stefanie Dengler and Paul Rusch
4. Deutsche Welle (DW) – www.dw.com/learngerman
5. BBC Languages – German – www.bbc.co.uk/languages/german
6. Goethe-Institut – www.goethe.de

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

Course Code: 25HS04PR0102-1 Course Name: Adventure Sports
25HS04PR0202-1

L: 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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS04PR0102-2 **Course Name: Introduction to Defense Forces**
25HS04PR0202-2 **& Obstacle Training**
L: 0 Hrs. P: 2Hrs. Per Week **Total Credits: 01**

Course Objective:

- Understand the Structure and Function of Defense Forces
- Familiarize with Defense Force Training and Discipline
- Learn Basic Obstacle Course Techniques
- Apply Problem-Solving and Teamwork in Obstacle Training
- 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:

- Describe the Structure and Functions of Defense Forces
- Demonstrate Knowledge of Defense Training Protocols
- Navigate Basic Obstacle Courses
- Collaborate and Problem-Solve in Team-Based Exercises
- Connect Obstacle Training to Defense Preparedness
- Evaluate and Reflect on Training Experiences

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

Course Code: 25HS04PR0102-3 **Course Name: First Aid & Disaster**
25HS04PR0202-3 **Management**
L: 0 Hrs. P: 2Hrs. Per Week **Total Credits: 01**

Course Objective:

- Understand Disaster Types and Characteristics
- Learn Risk Assessment and Management
- Master Emergency Preparedness and Response
- Explore Recovery and Reconstruction
- Develop Skills in Communication and Coordination
- Understand Legal and Ethical Considerations

Syllabus:

- Basic First Aid
- Transportation of Casualty
- Injury Prevention & Cure
- Various Types of Knots & Hitches
- Various team building activities
- Fire emergencies & use of extinguishers (Optional)
- Snake Bite & Environmental emergencies.

Course Outcome:

Upon successful completion of the disaster management course, students should be able to:

- Identify and Categorize Disasters
- Conduct Risk Assessments
- Develop Emergency Plans
- Implement Response Strategies

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

Course Code: 25HS04PR0102-4 Course Name: Basic Nutritional Course 25HS04PR0202-4

L: 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 I/II, B. TECH Computer Science & Engineering

Course Code: 25HS04PR0102-5 Course Name: Stress Management through Yoga
25HS04PR0202-5 & Meditation
L: 0 Hrs. P: 2 Hrs. Per Week Total Credits: 01

Course Objective:

Mental health is one of the most important facets of human life. Academic learning has emerged as a major source of stress among young students worldwide. Promoting mental well-being among students in India is a crucial step toward achieving Sustainable Development Goal 3 (Good Health and Well-being). Stress management involves using various techniques and strategies to control stress levels, improve how you react to stressful situations. Yoga combines physical movement with deep breathing and meditation, providing a holistic approach to stress relief.

Unit-1

Introduction to Stress: The Meaning of Stress, types of stress: distress, eustress
Stress Management Techniques I:
Treatment 1- (Asanas): Tadasana, Trikonasana, Vrikshasana, Garudasana,, Ardha-Padamasana, Padamasana, Vajarasana, Ushtrasana, Gomukhasna,, Paschimottanasan, ,Ardha Halasana, ,Setu-Bandhanasa,Naukasana, Bhujangasana, and Dhanurasana; along with relaxing asanas

Unit-2

Spiritual approach to stress management.
Stress Management Techniques II
Treatment 2 – (Prananyam) Deep breathing, Yoga, Mindfulness meditation
Rechak, Purak, Kumbhak, Nadi Suddhi and Bhramari Pranayama.
Measuring Academic stress- It can be measure using questionnaire: Academic stress Scale (Sun .et al 2011**).**

Course Outcome:

Upon successful completion of the course, students should be able to:

1. Understand the basics of stress management.
2. Analyze stress triggers and to manage them.
3. Evaluate the responses to stressful situations.
4. Apply the techniques of Yog & Meditation for stress management in day-to-day life.

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

Course Code: 25CS01TP0201 Course: Object Oriented Programming

L: 3 Hrs, P: 2Hr, Per Week Total Credits: 4

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-orientedprinciples 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 [SAP]

Course Code: 25CS01TP0202 **Course: Data Structure**

L: 3 Hrs, P: 2Hr, Per Week **Total Credits: 4**

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 [SAP]

Course Code: 25CS01PR0203 **Course: Operating Systems**

L: 3Hrs, P: 2Hr, Per Week **Total Credits: 4**

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'Reill

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

Course Code: 25CS01PR0204 **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 [SAP]

Course Code: 25CS06TP0205 Course: Integrated Business Processes in Cloud ERP II

L: 2Hrs, P: 2Hr, Per Week Total Credits: 3

Syllabus Content:

- Warehouse & Inventory Management
- Design to Operate Processing in SAP S/4HANA
- Lead to Cash Processing in SAP S/4HANA
- Project System
- SAP Enterprise Asset Management

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

Course Code: 25HS01TP0205 **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 Heidelber

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TH0301 **Course: Theory of Computation**

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

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.

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

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01T10302 Course: Design and Analysis of Algorithms
L: 3 Hrs, T: 2Hrs, P: 0 Hr, Per Week Total Credits: 4

Course Objectives

The objective of this course is

- to introduce students to techniques for effective problem solving in computing.
- developing skills to solve real life applications which involving algorithm development.
- making students capable of analyzing different paradigms and their complexities to solve a given problem in efficient way.

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.

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0303 **Course: Computer Networks**

L: 3Hrs, P: 2Hrs, Per Week **Total Credits: 4**

Course Objectives

1. To Introduce the fundamental concepts of each layer in the OSI and TCP/IP models.
2. To implement, and troubleshoot local area networks (LAN), wide area networks (WAN), and hybrid networks.
3. To Examine the transport layer protocols and their role in ensuring reliable data transfer.
4. To Investigate modern applications and technologies used in computer networks.

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, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ.

UNIT – III

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

UNIT - IV

Transport Layer: Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP). TCP congestion control.

UNIT - V

Application Layer: Domain Name Space (DNS), DDNS, File Transfer Protocol (FTP), WWW, HTTP, Bluetooth, Firewalls, SDN Network.

Course Outcomes:

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

1. Design basic computer network by choosing appropriate devices, protocols, and topologies to meet specific requirements as per OSI and TCP/IP layer functionality.
2. Apply the concepts of data link layer protocols (Ethernet) and error detection and correction mechanisms.
3. Implement and evaluate network routing algorithms such as RIP, OSPF, and BGP.
4. Implement transport layer protocols like TCP, UDP and analyze their role in data transfer and network technologies.

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. "Software-Defined Networking: Design and Deployment" by Patricia A. Morreale, Daniele Ceccarelli, Wiley.

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS06TP0305 Course: Basic ABAP Programming
L: 1 Hrs., P: 2 Hrs., Per Week Total Credits: 2

- Working with the ABAP development environment
- Basic techniques in the ABAP language
- Simple object-oriented concepts
- Using ABAP SQL to access the database
- Simple and complex data types
- Business objects and entity manipulation language
- The ABAP RESTful application programming model

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS06TP0306 Course: Intermediate ABAP Programming
L: 3 Hrs., P: 2 Hrs., Per Week Total Credits: 4

- Analyzing and testing code
- Data types and type conversions
- Processing character fields
- Using code pushdown in ABAP SQL
- Improving the performance of internal tables
- Implementing authorization checks
- Designing effective object-oriented code
- Defining and working with exception classes
- Adding documentation to ABAP code

Syllabus for Semester III, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01PR0304 **Course: Software Laboratory – I**

L: 0 Hrs., P: 4 Hrs., Per Week **Total Credits: 2**

Course Objectives

1. Introduce core Python concepts, including syntax, data types, control structures, and functions.
2. Explore Python's built-in data structures and their real-world applications in problem-solving.
3. To develop practical and efficient solutions for complex real-life challenges.

Practical's based on the following syllabus:

• Python Execution model and Basic building blocks of Python Programs/Scripts/Modules

• Various keywords, Operators, control and loop constructs used in Python

• User defined Function generation in Python

• Dealing with Python files, Modules and Packages SciPy, an Open Source Python- based library, which is used in mathematics, scientific computing, Engineering, and technical computing.

• Developing small mathematical applications using packages like Numpy, Matplotlib etc.

• Introduction of with Web scraping and its need

• Application development to scrape the web with the help of standard libraries like Requests and bs4(Beautiful Soup).

Course Outcomes:

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

1. Design Python programs using different data and control structures.
2. Use Python Files, Modules and Packages to handle complex python programs
3. Develop mathematical and scientific applications in python using numpy, scipy libraries
4. Create small applications for web scraping using standard libraries

Text Books

1. Learning Python: Powerful object-oriented programming, Mark Lutz, O'REILLY publications; 5th edition.
2. Introduction to Computing & Problem Solving with Python Jeeva Jose and P Sojan Lal Ascher, Khanna Book Publishing; First Edition (1 January 2019)
3. Problem Solving with Algorithms and Data Structures using Python by By Brad Miller andDavid Ranum, 2nd addition

Reference Books

1. Learning with Python, Allen Downey, Jeffrey Elkner ,Chris Meyers,Dreamtech Press; First Edition (1 January 2015)
2. The Python 3 Standard Library - Example (Developer's Library) by Doug Hellmann, second edition

Syllabus for Semester IV, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TH0401 **Course: Compiler Design**

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

Course Objectives

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

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

Unit-V

Storage allocation & Error Handling- Run time storage administration, stack allocation, Activation of Procedures, Storage Allocation Strategies, Garbage Collection, symbol table management,

Error handling, Error detection and recovery- lexical, syntactic and semantic, Error recovery in LL & LR Parser

Course Outcomes:

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

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

4. Implement different code optimization and code generation techniques using standard data structures.

Text Books

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

Reference Books

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

Syllabus for Semester IV, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0402 **Course: Database Management System**

L: 3Hrs, P: 2Hrs, Per Week **Total Credits: 4**

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.

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 IV, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0403 Course: Artificial Intelligence

L: 3 Hrs., P: 2Hrs, Per Week Total Credits: 4

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.

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

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

UNIT V:

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

Course Outcomes:

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

1. Explain the historical evolution, applications and problem-solving characteristics of AI.
2. Apply uninformed and informed search techniques and represent given problem using state space representation.

3. Utilize different AI techniques to solve fully informed two player games and constraint satisfaction problems.
4. Demonstrate knowledge representation techniques and Uncertainty theory in AI decision-making scenarios.

Text Books and Reference Books:

Text Books:

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

Reference Books:

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

Syllabus for Semester IVB. Tech. Computer Science & Engineering
Course Code: 25CS01PR0404 Course: Software Lab-II Advanced Linux
L: 0Hrs, P: 4Hrs, Per Week Total Credits: 2

Course Objectives:
The primary objective of this course is to provide students with in-depth knowledge and hands-on experience in advanced Linux system administration, shell scripting, and kernel-level programming.

Unit I: Linux Fundamentals and Host Administration
Linux installation, basic command-line usage, vi editor operations, software package management, user and group management, file permissions, bootloader (GRUB) configuration, hard disk partitioning and mounting, process monitoring and control, core system services, and kernel compilation.

Unit II: Shell Scripting and Linux Programming
Shell scripting basics, loops, conditionals, functions, system automation using scripts, introduction to Linux system programming, use of libipq, libnet, and libpcap libraries, packet handling, network control, and packet capture.

Unit III: Intranet Services Configuration
Linux networking fundamentals, DHCP server configuration, NFS server setup, Samba server setup, NIS server configuration, LDAP server installation and integration.

Unit IV: Internet Services and Security
FTP server configuration, SSH server setup, DNS configuration using BIND, web server deployment using Apache and Nginx, Squid proxy server setup, mail server configuration using Postfix and Dovecot, firewall configuration using iptables, VPN server deployment.

Unit V: Advanced Linux Kernel Programming
Kernel architecture, system call implementation, process management using task_struct, CPU scheduling, context switching, interrupt handling with softirqs and tasklets, synchronization using spinlocks and semaphores, timer management, page table and memory allocation, VFS internals, block layer, NVMe storage, TCP/IP networking stack.

Course Outcomes
On successful completion of the course, student shall be able to
1. Demonstrate proficiency in installing, configuring, and managing Linux systems, users, and core services.2.
2. Develop automated solutions using shell scripts and apply basic Linux programming with system libraries.3
3. Configure and manage intranet services such as DHCP, NFS, Samba, NIS, and LDAP.
4. Deploy and secure internet services including FTP, SSH, DNS, Web, Proxy, Mail, Firewall, and VPN servers.

5. Analyze and implement advanced Linux kernel functionalities including system calls, memory, scheduling, and networking.

Text Books:

1. Linux Administration: A Beginner’s Guide", Wale Soyinka, McGraw-Hill Education
2. UNIX and Linux System Administration Handbook, Evi Nemeth, Garth Snyder, Trent Hein, Ben Whaley, Dan Mackin, Pearson Education
3. Linux Kernel Development, Robert Love, Addison-Wesley

Reference Books

1. Understanding the Linux Kernel, Daniel P. Bovet, Marco Cesati, O’Reilly Media
2. Linux Command Line and Shell Scripting Bible, Richard Blum, Christine Bresnahan, Wiley

Syllabus for Semester IV, B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS06TP0405 Course: Advanced ABAP Programming
L: 3 Hrs., P: 2 Hrs., Per Week Total Credits: 4

- Data modeling in ABAP
- Creating database tables
- Defining global types
- Defining CDS views
- Defining relationships and associations between objects
- Using code pushdown in CDS views

Defining meta objects for ABAP dictionary objects and CDS views

1. Exploring he ABAP RESTful Application Programming Model
   - Exploring the Concept and Architecture
   - Defining a CDS-based Data Model
   - Defining an OData UI Service
2. Working with ABAP RESTful Application Programming Model Business Objects
   - Defining RAP BOs and their Behavior
   - Using the Entity Manipulation Language (EML) to Access RAP BOs
   - Understanding Concurrency Control
   - Defining Actions and Messages

Implementing Authority Checks

3. Adding Basic Operations Update and Create
   - Defining Static Field Control and Value Helps
   - Implementing Input Checks using Validations
   - Setting Values using Numbering and Determinations
   - Implementing Dynamic Feature Control
4. Developing Draft-enabled Services
   - Understanding the Draft Concept
   - Implementing the Behavior of Draft-Enabled BOs
5. Defining Compositions
   - Defining Composite RAP Business Objects
   - Defining Compositions in OData UI Services
   - Implementing the Behavior of Composite Business Objects
6. Implementing Unmanaged Data Access
   - Exploring the Behavior Implementation Options
   - Implementing Unmanaged Business Objects
   - Implementing Data Access in Managed Business Objects
7. Integrating Business Events
   - Raising and Handling Business Events
   - Working with Event Parameters
8. Enabling and Using Extensibility
   - Exploring Extensibility Options
   - Enabling Data Model Extensibility

- Developing Data Model Extensions

Enabling and Developing Behavior Extensions

1. SAP S/4HANA Extensibility Overview
   - Get to know about the extensibility concept in SAP S/4HANA
2. SAP Fiori Launchpad Adaption
   - Personalize the SAP Fiori launchpad
   - Manage the SAP Fiori launchpad content
   - Extend the SAP Fiori launchpad
3. Key User Extensibility
   - Use variant management
   - Use SAP Fiori runtime authoring
   - Create data source extensions
   - Create custom fields
   - Enable custom database fields for usage in SAP Fiori applications
   - Create custom logic
   - Create custom business objects
   - Create a UI for a custom business object
   - Add custom logic to a custom business object
   - Create custom libraries and methods
   - Create custom code lists
   - Transport extension items
4. Side-by-Side Extensibility
   - Describe essential features of side-by-side extensions
   - Name the most important factors that influence the choice of the extensibility option
5. Develop an extension for SAP S/4HANA with SAP BTP ABAP Environment

Syllabus for Semester IV, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01PR0405 Course: Community Engagement Project

L: 0 Hrs, P: 4Hr, Per Week Total Credits: 2

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 [SAP]

Course Code: 25CS01PR0406 Course: Creativity, Innovation & Design Thinking

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

Course Objectives

1. Develop a human-centered 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.

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

Design Thinking: Understanding the design thinking approach, Human centered design, Case Studies on Innovation business ideas like Amazon, Swiggy, Red bus, Flip fart, Ola, Big Basket, methods and techniques — organizational Aspects — Economic Aspects like venture capital, angel investors — Evaluation of Effectiveness of Innovation

Unit VI

Ethical Considerations: Introduction to intellectual property rights - Patents, Copyrights©,

Trademarks®, Trade Secret, Unfair Competition.

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

Syllabus for Semester IV, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01PR0407 Course: Basic Competitive Coding

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

The course will cover exercises based on following topics

- Arrays – Matrices – Strings – Time and Space Complexity – TLE – MLE
- Hash Map – Hash Set – Tree Map – Tree Set
- Stacks – Queues – Problems – Heap – Priority Queue – Problems
- Linked Lists – Traversal based Problems
- Trees – Types – Traversals

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

Course Code: 25CS01TP0501 **Course: Machine Learning**

L: 3 Hrs., P: 2Hrs, Per Week **Total Credits: 4**

Course Objectives:

1. To introduce the basic concepts and techniques of machine learning.
2. To understand major machine learning algorithms.
3. To identify machine learning techniques suitable for a given problem.

UNIT – I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

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

Course Outcomes:

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

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

Text Books

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan
Kaufmann, 1986.
2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, Morgan Kaufmann, 2003.
2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988.
3. Ethem Alpaydin, Introduction to Machine Learning, PHI.

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

Course Code: 25CS01TP0502 **Course: Software Engineering**

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

Course Objectives

1. To familiarize students with the fundamentals of software engineering principles and practices.
2. To aid students in designing software systems using structured and object-oriented approaches.
3. To apprise students with different software testing and debugging strategies in building a quality software.
4. To introduce students to the practice of software project management.

Unit-I

The Evolving Role of Software - Software Characteristics, Applications, Principles and Myths; Software Engineering as a Layered Technology; Software Process Framework.
Software Process Models - Waterfall Model, Evolutionary Models, Unified Process Model, Agile Process Models, Extreme Programming (XP), Scrum Model; Requirements Engineering.

Unit-II

Requirements Analysis, Analysis Modeling Approaches; Data Modeling, Object-Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, Class-based Modeling, Behavioral Model, Design Concepts, The Design Model, Component Level Design, User Interface Design.

Unit-III

Basic concepts of Testing, Software Testing Life Cycle (STLC), Verification and Validation, Unit Testing, Integration Testing, Validation Testing, System Testing,
Art of Debugging. White-Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing, Equivalence Partitioning, Boundary Value Analysis, Web Testing, Test case design, Building, Execution, Automated Testing.

Unit-IV

Software Project management- Plans, Methods and Methodology; Project Success and Failure, Project Evaluation, Cost-benefit evaluation technique, Project Planning & Scheduling.
Software Effort Estimation- Albrecht Function Point Analysis, COSMIC Function Point, Cost Estimation, COCOMO Model, Project Scheduling. Software Quality.
A Framework for Product Metrics, Metrics for Analysis & Design Models, Metrics for Source Code, Metrics for Testing & Maintenance. Metrics for process & project - Software measurement.

Unit-V

Risk management - Risk strategies, Software risks, Risk identification, Risk refinement,

RMMM Risk Response development & Risk Response Control, Risk Analysis.
Change Management- Software Configuration Management, SCM Repository, SCM Process, Estimation, Reengineering- Software reengineering, Reverse engineering.

Course Outcomes:

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

1. Elucidate software engineering practices and various process models.
2. Use software design approaches for designing real-time solutions.
3. Demonstrate White Box Testing and Black Box Testing for building bug-free quality software.
4. Integrate software project management practices in software product development.

Text Books

1. Roger S. Pressman and Bruce R. Maxim; Software Engineering – A Practitioner's Approach; Eighth Edition, McGraw Hill; 2015.
2. Ian Somerville; Software Engineering; Seventh Edition; Pearson Education. 2008.

Reference Books

1. Pankaj Jalote; An Integrated Approach to Software Engineering; Third Edition, Springer, 2005.
2. Rajib Mall; Software Project Management, 5th Edition, McGrawHill.
3. David Gustafsan; Software Engineering;Schaum's Series,Tata McGraw Hill,2002.

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

Course Code: 25CS01TP0503 **Course: Cloud Computing**

L: 3 Hrs., P: 2Hrs, Per Week **Total Credits: 4**

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Cloud computing and develop skills required to design real-life cloud-based projects by:

1. Learning basics of cloud and challenges in implementation.
2. Identifying areas where cloud computing can be applied.
3. Understanding the cloud environment and its security issues.
4. Understanding the various cloud programming and software environments.

UNIT I:

Introduction: Evolution of Cloud Computing –Underlying Principles of Parallel Distributed Computing, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning, Applications, deployment models - Public, Private and Hybrid Clouds, and service models- Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage. Software as a Service (SaaS) - Anything as a service (XaaS).

UNITII:

Virtualization: Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Issues with virtualization, virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, introduction to Various Hypervisors, virtualization of data centers, and Issues with Multi-tenancy.

UNIT III:

Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, and Load Balancing, various load balancing techniques.

UNIT IV:

Interoperability, Migration and Fault Tolerance: Issues with interoperability, Vendor lock-in, Interoperability approaches, Broad Aspects of Migration into Cloud, Migration of virtual Machines and techniques. Fault Tolerance Mechanisms. Security: Vulnerability Issues and Security Threats, Application-level Security, Data level Security, and Virtual Machine level Security, Infrastructure Security, and Multi-tenancy Issues.

UNIT V:

Cloud Programming and Applications: Health care Analytics and Predictive Modelling Financial Data Analysis and Fraud Detection E-commerce Analytics

for Customer Insights Smart City Solutions with Cloud (case Studies), Deployment of Web Services from Inside and Outside a Cloud Architecture.

Course Outcomes:

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

1. Understand the architecture, models, and characteristics of cloud computing
2. Apply virtualization and resource management techniques in cloud environments.
3. Analyze security, interoperability, and deployment issues in cloud-based systems.
4. Implement cloud solutions for real-world applications using appropriate tools and platforms.

Text Books

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, ―Distributed and cloud computing from Parallel Processing to the Internet of Things‖, Morgan Kaufmann, Elsevier –2012
2.Cloud Computing Principles and Paradigms‖, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publishers.2011

Reference Books

1. Barrie Sosinsky, ― Cloud Computing Bible‖ John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, ―Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance‖, O'Reilly 2009
3. Cloud Computing: A Practical Approach, Toby Velte, Anthony T Velte, Robert Elsenpeter, McGraw Hill,2009

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

Course Code: 25CS06TP0503 **Course: Fiori Programming**

L: 4 Hrs., P: 2 Hrs., Per Week **Total Credits: 5**

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1. End-User Perspective
   - SAP Fiori Design and SAP Fiori Launchpad
   - Personalization and Data Handling
2. Technology
   - User Interface and Data Services
   - Application Types and SAP Fiori App Recommendations
3. Architecture
   - ABAP Platform and SAP HANA
   - SAP S/4HANA and SAP Fiori Development
4. Content Management
   - Spaces, Groups, and Catalogs
   - SAP Fiori Launchpad Content and Application Manager
   - Catalog Types and App Descriptors
   - Tiles and Target Mappings
5. Content Administration
   - Rapid Activation and Predefined Roles
   - Launchpad Configuration and Troubleshooting
6. Adaptation
   - UI Theme Designer
   - Adapt and Extend SAP Fiori Launchpad
7. Mobility
   - SAP Fiori Mobile
   - SAP Fiori for iOS
8. Integration
   - SAP Business Technology Platform
   - SAP Build Work Zone, standard edition
   - SAP's UX Strategy
   - SAPUI5 Overview
   - SAP Business Application Studio
   - Loading and Initializing SAPUI5
   - Modules and Dependencies
   - Views and Controllers
   - Components
   - Implementing the UI
   - Fragments
   - Models and Data Binding
   - Localization
   - OData Services

- OData Model
- Routing and Navigation

1. SAP User Experience and SAPUI5 Strategy
2. MVC Review and Advanced UI Controls
   - Databinding review
   - Best practices SAPUI5
   - SAPUI5 navigation concept
   - Implementing Full-screen Application
   - Implementing Master-Detail Application
   - Working with Messages
   - Implementing Responsive behavior
   - Extending Standard controls
   - Describing custom controls
   - Implementing XML Composite Controls
   - Creating Control and Component Libraries
   - Implementing QUnit and One-Page Acceptance Tests
3. Advanced Data Handling
   - Describing Remote vs. Local Data
   - Working with Mock Server
   - Working with ODataModel
   - Describing OData Deep Insert
   - Working with SAPUI5 Smart Controls
   - Introduction into SAP Fiori Elements
4. Application Adaption and Extension – Introduction
   - Introduction into SAP Flexibility
   - Explaining Extension Points
   - Describing other Types of Extensibilities
5. Version Control – Working in Teams
   - Working with GIT
   - Working with GIT Repositories
   - Working with Branches

Syllabus for Semester V B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01PR0505 Course: Design Patterns Lab

L: 0Hr, P: 4 Hrs., Per Week Total Credits: 2

Course Objectives:

- To implement and validate commonly used design patterns using an object-oriented programming language.
- To build small-scale applications that demonstrate the usage of individual design patterns.
- To analyze the impact of design patterns on code reusability, scalability, and maintainability.
- To identify anti-patterns and refactor code for better design

UNIT-I:
Elements of Design Pattern, Describing Design Pattern, Design Pattern Classification, Role of design patterns in software design, Example implementation of design pattern using UML.

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

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

UNIT-IV:
Behavioral Patterns-I: Introduction, Role of Behavioral pattern, Encapsulation of Behavior, Behavioral Pattern types: Chain of Responsibility, Template Method, State, Strategy, and Iterator, Comparative study of Behavioral patterns, and implementations based on real life applications.

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

Course Outcomes

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

1. Apply various design patterns in practical coding problems.
2. Build modular and maintainable systems using object-oriented principles.
3. Refactor existing code using design patterns to improve design quality.
4. Develop mini-projects showcasing real-life applications of multiple design patterns.

Text Books:

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

Reference Books:

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

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

Course Code: 25CS01TP0601 **Course: Deep Learning-I**

L: 3 Hrs, P: 2Hrs, Per Week **Total Credits: 4**

Course Objectives

1. To introduce basic deep learning algorithms.
2. To understand real-world problems which can be solved by deep learning methods.
3. To identify deep learning techniques suitable for a real-world problem.

UNIT I:

Basics of Deep Learning History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons,, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons.

UNIT II:

Training of Feedforward Neural Networks Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, Training of Feedforward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam

UNIT III:

Optimization Algorithm Activation Function and Initialization Methods: Sigmoid, Tanh, ReLU, Xavier and He Initialization, Regularization: Bias and Variance, Overfitting, Hyperparameters Tuning, L1 and L2 Regularization, Data Augmentation and Early Stopping, Parameter Sharing and Tying.

UNIT IV:

Convolutional Neural Network (CNN) Convolutional Neural Networks, 1D and 2D Convolution, Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V:

Recurrent Neural Network (RNN) Recurrent Neural Networks, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Long Short-Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs). **Variants of CNN and RNN** Encoder-Decoder Models, Attention Mechanism, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet

Course Outcomes:

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

1. **Apply** fully connected deep neural networks to real-world problem-solving scenarios.
2. **Evaluate** the performance of various deep learning models in terms of optimization, bias-variance trade-off, overfitting, and underfitting.
3. **Analyze** the role of convolutional and recurrent neural networks in addressing different real-world problems.
4. **Create** advanced deep learning models by designing variants of CNNs and RNNs tailored to specific applications.

Text Books

1. Sandro Skansi, *Introduction to Deep Learning*, Springer
2. Charu C. Aggarwal, *Neural Networks and Deep Learning: A Textbook*, Springer, 2019
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press, 2016
4. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, *Deep Learning using Python*, Wiley Publication

Reference Books:

1. Bishop, C. M., *Pattern Recognition and Machine Learning*, Springer, 2006
2. Yegnanarayana, B., *Artificial Neural Networks*, PHI Learning Pvt. Ltd., 2009

A. Ravindran, K. M. Ragsdell, and G. V. Reklaitis, *Engineering Optimization: Methods and Applications*, John Wiley & Sons, Inc., 2016

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0602 Course: Generative AI

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives:

1. Understand the fundamental concepts of Generative AI.
2. Explore utility of autoencoders, GAN, LLM in Generative AI.
3. Use prompt engineering techniques to retrieve data from LLM.
4. Explore various techniques of Explainable and Responsible Generative AI.

Unit-1 Fundamentals of Generative AI

Generative AI, Overview, history, applications, Generative vs. Discriminative models, Latent variables and representation learning, Types of generative models, challenges in Generative AI, Generative Model Lifecycle, Evaluation metrics: FID, IS, BLEU, Perplexity.

Unit-2 Autoencoders and GANs.

Autoencoders (AE): basic, denoising, and variational (VAE), Latent space interpretation and reconstruction loss, GANs: Generator-Discriminator framework, adversarial training, Variants: DCGAN, WGAN, Conditional GAN, CycleGAN, StyleGAN, Training challenges and stabilization techniques.

Unit-3 Large Language Models and Transformer Architectures

Introduction to LLMs, Evolution, Transformer architecture: self-attention, encoder-decoder structure, GPT, BERT, T5, LLaMA, DALL·E, fine-tuning paradigms, Applications: summarization, translation, code generation, chatbots, challenges and limitations.

Unit 4: Introduction to Prompt Engineering

Prompt Engineering basics, Prompting strategies: zero-shot, few-shot, chain-of-thought Self-consistency Meta-prompting, Key Elements of Effective Prompts, Prompting in multimodal models: CLIP, DALL·E, Stable Diffusion, Evaluation of prompts and prompt optimization

Unit 5: Explainable and Responsible Generative AI

Explainable AI basics, XAI techniques: SHAP, LIME, Integrated Gradients, attention visualization, Explainability in LLMs and GANs.

Responsible AI: principles, bias and fairness in generative models, Regulatory frameworks and ethical guidelines (EU AI Act, OECD AI Principles, NIST AI Risk Framework)

Course Outcomes:

At the end of the course, a student will be able to:

1. Utilize Generative AI fundamentals to apply autoencoders and GANs for image synthesis.
2. Analyze transformer-based architectures and large language models for diverse applications.
3. Use Prompt Engineering techniques to design and optimize effective prompts.
4. Apply Explainable AI techniques to interpret GenAI models and ensure responsible usage.

TEXT BOOKS:

1. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, David Foster, O'Reilly Media, 2nd Edition,2022.
2. The Art of Prompt Engineering with ChatGPT: A Hands-On Guide - Learn AI Tools the Fun Way, Shroff/Hunter; First Edition,2023.
3. Interpretable Machine Learning,: A Guide for Making Black Box Models Explainable, Christoph Molnar ,Shroff/Molnar, Second Edition,2020.
4. Responsible AI: Best Practices for Creating Trustworthy AI Systems, Qinghua Lu, Liming Zhu, et al, Pearson publisher, Ist Edition, 2024.

REFERENCE BOOKS:

1 Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville MIT Press, 2016.

2 Transformers for Natural Language Processing, Denis Rothman Packt Publishing, 2nd Edition, 2022.

Prompt Engineering for Generative AI, James Phoenix, Mike Taylor, O'Reilly, 2024.

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

Course Code: 25HS02TP0601 **Course: Business Communication**

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

Course Objective

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

UNIT 1: Fundamentals of Business Communication

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

UNIT 2: Business Correspondence

Planning, Writing, and Completing Business Messages

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

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

UNIT 3: Visual and Content Creation

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

UNIT 4: Report

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

UNIT 5: Communication for Employment

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

Course Outcomes

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

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

Text Books

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

Reference Books

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

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

Course Code: 25CS01PR0605 **Course: Mini Project**

L: 0 Hr, P: 4Hrs, Per Week **Total Credits: 2**

Course Objectives

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

Course Outcomes:

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

1. Identify and finalize the problem statement by investigating various domains and society needs.
2. Perform requirement analysis and design methodology for solving the identified problem.
3. Apply programming techniques and modern tools for the development of the solution.
4. Apply ethical principles, project management skills and demonstrate the ability to work in teams for project development within the confines of a deadline.
5. Communicate technical information employing written reports and presentations.

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

Course Code: 25CS01PR0606 Course: Advanced Competitive Coding

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

The course will cover exercises based on following topics

- Trees – BST – Insertion – Views: Top, Left, Right, Bottom
- Trees – Path Based Problems
- Greedy – Divide and Conquer – Back Tracking
- Sliding Window – Sub Arrays – 2 Pointer Technique
- Dynamic Programming – Memoization vs Tabulation
- One Dimensional and 2 Dimensional DP
- Graphs – Traversals – MST – Dijkstra – Bellman Ford Algorithms

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

Course Code: 25CS06TP0608 **Course: Fiori Programming II**

L: 2 Hrs., P: 2 Hrs., Per Week **Total Credits: 3**

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1. SAP UX Strategy
2. SAP Fiori Elements, Overview
3. List Report
4. Object Page
5. Advanced Topics of List Report and Object Page
6. Overview Page
7. Analytic List View
8. Adapt and extend SAP Fiori Element application
9. SAP Fiori Launchpad
10. SAP Fiori Design Guidelines
11. Patterns
12. App Types
13. UIs according SAP Fiori App Types
14. Transactional UIs
15. Fact Sheet UIs
16. Analytical UIs
17. UI2 Services
18. Enhancing SAP Fiori UIs
19. View Extension
20. View Modification
21. View Replacement
22. Controller Extension
23. Introduction into SAP Fiori Elements
24. Development Infrastructure

Syllabus for Semester VII B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01TP0701 Course: Deep Learning-II
L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives:

1. Understanding the fundamentals of deep learning and its applications in generative models.
2. Learning to train and evaluate generative models on different types of data such as images, text, and audio.
3. Developing practical skills in implementing and fine-tuning generative models using popular deep learning frameworks.

Unit I :

Directed Graphical Models**:** Probability Theory, Joint Distributions, representations of joint distribution, graphical representation of joint distribution, reasoning in a Bayesian network, Causal Reasoning, Evidential Reasoning, Independencies encoded by a Bayesian network (Case 1: Node and its parents), Independencies encoded by a Bayesian network (Case 2: Node and its non-parents), Independencies encoded by a Bayesian network (Case 3: Node and its descendants)

Unit II :

Markov Networks: Motivation, Factors in Markov Network, Local Independencies in a Markov Network, Using joint distributions for classification and sampling, concept of a latent variable.

Unit III:

Restricted Boltzmann Machines: Introduction to Restricted Boltzmann Machines, RBMs as Stochastic Neural Networks, Unsupervised Learning with RBMs, Computing the gradient of the log likelihood, Motivation for Sampling.

Unit IV:

Markov Chains: Introduction to Markov Chains, Need of Markov Chains, setting up a Markov Chain for RBMs, Training RBMs using Gibbs Sampling, Training RBMs using Contrastive Divergence.

Unit V:

Variational Autoencoders: Revisiting Autoencoders, Variational Autoencoders: The Neural Network Perspective, Variational autoencoders: (The graphical model perspective), Neural Autoregressive Density Estimator, Masked Autoencoder Density Estimator.

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

1. Use probability concepts to build directed graphical models and markov networks.
2. Solve problems using Restricted Boltzmann Machines and markov chains.
3. Apply autoencoder model to find solution of a given problem.

Text Books:

1. Ian Good fellow and Yoshua Bengio and Aaron Courville. *Deep Learning*. An MIT Press book. 2016.
2. Charu C. Aggarwal. *Neural Networks and Deep Learning: A Textbook*. Springer. 2019.
3. Christopher Bishop. *Pattern Recognition and Machine Learning*. Springer Verlag, 2006.

Reference Books:

1. *Deep Learning from Scratch: Building with Python from First Principles* by Seth Weidman published by O`Reilley.
   Grokking Deep Learning by Andrew W. Trask published by Manning Publications

Syllabus for Semester VII B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01TP0703 Course: Data Mining and Analytics
L: 2Hrs, P: 2Hrs, Per Week Total Credits: 3

Course Objectives:

1. Understand foundational concepts of data mining and knowledge discovery.
2. Apply various data mining techniques like classification, clustering, and association rules.
3. Gain practical skills in data analysis and visualization using modern tools.
4. Analyze and interpret data for real-world applications and decision-making.
5. Understand privacy implications of data analytics.

Unit I: Data Mining Introduction

Introduction to Data Mining and Knowledge Discovery Process, Types of Data: Structured, Semi-structured, Unstructured, Data Preprocessing: Cleaning, Integration, Transformation, Reduction, Challenges in Data Mining, Applications in various domains like Healthcare, E-commerce, Finance

Unit II: **Association and Classification Techniques**

Association Rule Mining: Apriori Algorithm, FP-Growth Algorithm, Measures of Rule Interestingness Classification Techniques: Decision Trees (ID3, C4.5, CART), Naive Bayes Classifier, k-Nearest Neighbors (KNN), Evaluation Metrics: Confusion Matrix, Accuracy, Precision, Recall, F1-score

Unit III: **Clustering and Outlier Detection**

Clustering Techniques: K-Means Clustering, Hierarchical Clustering (Agglomerative/Divisive), DBSCAN, Cluster Evaluation Techniques, Outlier Detection Methods: Distance-based, Density-based

Unit IV: **Data Analytics and Visualization**

Data Analytics Lifecycle, Descriptive, Predictive, and Prescriptive Analytics, Exploratory Data Analysis (EDA), Data Visualization using:, Python Libraries: Matplotlib, Seaborn. Tools: Tableau / Power BI / Orange, Basic Time Series Analysis Concepts

Unit V: **Applications, Tools, and Real-life Use Cases**

Applications of Data Mining in Real-World Scenarios, Case Studies: Market Basket Analysis, Customer Segmentation, Fraud Detection, Tools and Platforms Overview: WEKA, RapidMiner, Privacy in Data Mining

Course Outcomes

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

1. **Understand** basic concepts of data mining, knowledge discovery, and data preprocessing techniques.
2. **Apply** classification and association rule mining techniques on datasets and evaluate their performance.
3. **Implement** clustering and outlier detection algorithms to uncover patterns in data.

4. **Perform** exploratory data analysis and create insightful visualizations and analyze real-word problems

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei – Data Mining: Concepts and Techniques, 4th Edition, Morgan Kaufmann
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne Introduction to Data Mining 2nd Edition, Pearson Education

Reference Books

1. Jure Leskovec, Anand Rajaraman, Jeffrey Ullman, Mining of Massive Datasets, 3rd Edition, Cambridge University Press
   Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Springer

Syllabus for Semester VIII, B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01PR0803 **Course: Internship and Project Work**

L: 0 Hr, P: 24 Hrs, Per Week **Total Credits: 12**

Course Objectives

The objective of project is to let the students apply theoretical knowledge and practical skills acquired in the previous semesters to solve a real-world problem by developing an innovative, and efficient solution while enhancing problem-solving, teamwork, and research capabilities.

Course Outcomes:

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

1. Identify and finalize the problem statement by investigating various domains and society needs.
2. Perform requirement analysis and design methodology for solving the identified problem.
3. Apply programming techniques and modern tools for the development of the solution.
4. Apply ethical principles, project management skills and demonstrate the ability to work in teams for project development within the confines of a deadline.
5. Communicate technical information employing written reports and presentations.

Program Elective -I

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

Course Code: 25CS01TH0506-02 **Course: Computer Graphics**

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

Course Objectives

1. Understanding and applying advanced graphics algorithms, including clipping, filling, and curve generation for effective image construction.
2. Introducing the fundamentals of 3D graphics, focusing on basic transformations, projections, and simple object representations.

UNIT - I

Introduction to Graphics: Importance of Computer Graphics, Graphics Hardware, Application of Computer Graphics, Raster and Vector Graphics, Raster scan display system, Raster graphics Algorithm.

UNIT - II

Polygon filling methods: Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence Fill and Edge Flag Algorithm, Seed Fill Algorithms: Simple and Scan Line Seed Fill Algorithm

UNIT - III

2D Clipping algorithms for regular and irregular windows: Sutherland Cohen Out code, Sutherland Cohen Subdivision, Mid-Point subdivision, Cyrus Beck, Liang–Barsky Algorithm, Polygon Clipping Algorithms.

UNIT - IV

2D Transformations, Normalized Device Coordinates, Viewing Transformations, 3D System Basics and 3D Transformations and Projections.

UNIT - V

Hidden line & hidden surface removal algorithms, Painter's algorithm, Z-buffer, Warnock’s algorithm, and Back face detection. Rendering, Shading, Ray tracing techniques, Illumination methods, Color models.

Course Outcomes:

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

1. Implement various raster graphics algorithms and solid area scan conversion techniques.
2. Apply windowing, various line and polygon clipping algorithms.
3. Process geometric data using transformations and projection techniques.
4. Apply the concepts of color models, lighting and shading models, hidden surface elimination, and rendering models to enhance the image quality.

Text Books

1. Rogers; Procedural Elements of Computer Graphics; 3rd Edition; McGraw Hill, 2001.
2. Newman and Sproull; Principles of Interactive Computer Graphics; McGraw Hill, 1989.
3. Hearn and Baker; Computer Graphics; 2nd Edition; PHI, India, 1994.
4. Ivan Harringhton; Computer Graphics - A Programming Approach; McGraw Hill Publications, 1987.
5. Computer Graphics Using OPENGL- 2nd edition, F.S. Hill Jr. Pearson Education, 2003

Reference Books

1. James D. Foley, Andries Van Dam, Feiner Steven K. and Hughes John F. – Computer Graphics: Principles & Practise, Adddison Wesley Publishing House

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

Course Code: 25CS01TH0506-01 Course: E Commerce & ERP

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

Course Objectives:

The objective of this course is to:

- Understand the fundamentals and frameworks of E-Commerce and ERP.
- Explore business models and technologies in E-Commerce.
- Study the architecture, components, and implementation of ERP systems.
- Analyse the integration of business processes through ERP solutions.
- Evaluate case studies to understand real-world applications of E-Commerce and ERP.

Unit I: Introduction to E-Commerce

Definition, Evolution, and Impact of E-Commerce. E-Commerce Framework, Business Models: B2B, B2C, C2C, G2C. Benefits and limitations. E-Commerce Infrastructure: Internet, Intranet, Extranet, World Wide Web.

Unit II: **Electronic Payment Systems & Security**

Types of Electronic Payment Systems: Credit Cards, Debit Cards, E-Cash, E-Wallets, Smart Cards. Electronic data interchange, Risk and security issues: Encryption, Firewalls, SSL, Secure Electronic Transaction (SET), Digital Signatures and Certificates.

Unit III: **ERP Fundamentals**

ERP Introduction: Overview, Evolution, Need, Characteristics, Benefits. ERP Architecture: Technical and Functional Modules. Business Process Reengineering and ERP. ERP and Related Technologies: SCM, CRM, Data Warehousing.

Unit IV: **ERP Implementation and Lifecycle**

ERP Implementation Lifecycle: Planning, Selection, Implementation, Training, Maintenance. Critical Success Factors and Challenges. Role of Consultants, Vendors, and Users. Post-Implementation Review and Support.

Unit V: **Case Studies and Trends**

Case Studies of E-Commerce platforms (e.g., Amazon, Flipkart). ERP Case Studies (SAP, Oracle, Microsoft Dynamics). Emerging Trends: M-Commerce, Social Commerce, Cloud ERP, Open Source ERP.

Course Outcomes

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

1. Understand the structure and components of E-Commerce systems.
2. Analyse electronic payment methods and secure transaction techniques.
3. Describe ERP architecture and business process integration.
4. Plan and evaluate ERP implementation phases.
5. Interpret and analyse real-world case studies of E-Commerce and ERP solutions.

Text Books:

1. **E-Commerce: Fundamentals and Applications** – Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, Wiley India
2. **ERP Demystified** – Alexis Leon, Tata McGraw-Hill Education
3. J. Joseph – E-Commerce: an Indian perspective – PHI
4. Vinod Kumar Garg and Venkitakrishnan N K – Enterprise Resource Planning Concepts and Practice – PHI

Reference Books

1. **Electronic Commerce: A Managerial Perspective** – Efraim Turban, David King, Pearson Education
2. **Enterprise Resource Planning** – C. S. V. Murthy, Himalaya Publishing
3. **Introduction to E-Commerce** – Jeffrey F. Rayport and Bernard J. Jaworski, Tata McGraw-Hill

Program Elective -II

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01TP0603-01 Course: Cloud Administration
L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Unit 1: Azure Administration Essentials

- Introduction to Azure architecture and services
- Azure portal, CLI, PowerShell, and Cloud Shell
- Azure regions, availability zones, and resource groups
- Manage Azure subscriptions and billing
- Implement Role-Based Access Control (RBAC)
- Introduction to Azure Resource Manager (ARM) templates

Unit 2: Identity and Governance in Azure

- Azure Active Directory (AAD) overview
- Users, groups, and roles management
- Configure multi-factor authentication (MFA)
- Implement Conditional Access and Privileged Identity Management (PIM)
- Governance: Policies, Blueprints, and Locks
- Hands-on: Creating users, assigning roles, configuring RBAC

Unit 3: Azure Compute, Storage and Networking

- Create and manage virtual machines (Linux & Windows)
- Configure availability sets and scale sets
- Configure Azure Storage (Blob, File, Queue, Table)
- Implement Azure Disks and snapshots
- Create Virtual Networks (VNets), Subnets, NSGs, and route tables
- Deploy Load Balancers and Application Gateways
- Hands-on: Deploy VM with VNet and secure it using NSGs

Unit 4: Monitoring, Backup and Disaster Recovery

- Azure Monitor, Metrics, Logs, and Alerts
- Configure Diagnostic settings and Log Analytics
- Implement Azure Backup and Site Recovery (ASR)
- Configure and use Azure Recovery Services vault
- Hands-on: Set up backup for a VM and configure monitoring with alerts

Unit 5: Automation, Optimization, and Exam Preparation

- Automate tasks using Azure Automation (Runbooks)
- Use PowerShell and CLI scripts for VM and storage tasks
- Cost management: Budgets, alerts, recommendations
- Performance tuning and rightsizing
- AZ-104 exam structure, domains, and sample questions
- Final project: Deploy and administer a secure and monitored Azure infrastructure

Suggested Lab Exercises

- Create resource groups, VMs, and storage accounts
- Configure RBAC and test access restrictions

- Setup backup and disaster recovery for critical resources
- Automate patch management using Azure Automation
- Monitor VMs and trigger alerts on threshold breaches

Course Outcomes (COs)

1. Explain and manage core Azure services and subscriptions.
2. Implement identity and access control using Azure Active Directory.
3. Configure virtual machines, storage accounts, and networking in Azure.
4. Monitor Azure resources and implement backup, security, and disaster recovery.
5. Automate and optimize operations using CLI, PowerShell, and Azure tools.

Textbooks

1. **Exam Ref AZ-104 Microsoft Azure Administrator** – Harshul Patel (Microsoft Press)
2. **Microsoft Azure Infrastructure Services for Architects** – John Savill
3. **Hands-On Azure for Administrators** – Mustafa Toroman

Reference Books

1. **Microsoft Learn: AZ-104 Learning Path** – learn.microsoft.com
2. **Cloud Computing: Concepts, Technology & Architecture** – Thomas Erl
3. **Azure for Architects** – Ritesh Modi
4. **The Azure Cloud Native Architecture Mapbook** – Stephane Eyskens
5. **Azure Well-Architected Framework** – Microsoft Documentation

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TH0603-02 Course: Basics of Ethical Hacking

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

Course Objectives:

1. Learn about the hacker mindset and the history of hackers
2. Understand basic networking and security technologies
3. Gain a basic understanding of security policy
4. Explore various vulnerability analysis techniques.

Unit-1: Introduction and Ethics: Ethical Hacking, Types of Hackers, Phases of Ethical Hacking, Fundamentals of computer networking. TCP/IP protocol stack, IP addressing and routing, Common Network Threats/Attacks

Unit-2: Cryptography: Introduction to cryptography, private-key encryption, public-key encryption, Key exchange protocols, cryptographic hash functions, applications, Digital signatures, Attacks on cryptosystems.

Unit-3: Vulnerability Analysis & System Hacking: Vulnerability Analysis, Types of Vulnerability Analysis, Vulnerability Assessment Tools, System Hacking, Password Cracking, Penetration testing, Hiding Files, Clearing logs.

Unit-4: DoS and Session Hijacking: DoS attack, DDoS attack, Common symptoms of DoS/DDoS attack Categories of DoS/DDoS Attack Vectors, session hijacking, Application and Network, Level session hijacking.

Unit-5: Sniffing: Malware and its propagation ways, Malware components, Types of malware, Concept of sniffing, Types of sniffing, Types of sniffing attacks
IDS & Firewall: Intrusion Detection System (IDS), Types of Intrusion Detection Systems, Introduction to Firewalls, Types of Firewalls, Introduction to Honeypots, Case studies: various attacks scenarios and their remedies.

Course Outcomes

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

1. Develop the core foundations of ethics and cryptography in regards to computer security
2. Analyzing the vulnerability with respect to hacking, DDOS attack and session hijacking
3. Classify various types of malware and sniffing attacks on network
4. Analyzing various attacks scenario and remedies and detecting the attack with IDS

Textbooks:

1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, 2nd Edition, Patrick Engebreston, ISBN: 0124116442

Reference Books

1. Penetration Testing: A Hands-On Introduction to Hacking, Georgia Weidman, ISBN: 1593275641

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

Course Code: 25CS01TH0603-03 Course: Digital Image Processing

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

Course Objectives:

- To understand fundamentals of digital image representation and processing.
- To explore techniques for image enhancement, restoration, segmentation, and compression.
- To apply algorithms for object recognition and real-world image processing problems.

Unit I:

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system, Image sensing and acquisition, sampling and quantization of an Image, Basic relationship between pixels, Image representation, types of images (binary, grayscale, color, indexed), and Mathematical operations.

Unit II:

Image Enhancement: Spatial Domain methods- Intensity transformations, Histogram Processing;
Image smoothing and sharpening (linear and nonlinear filters) ;
Frequency Domain methods- Basics of filtering in frequency domain, The Fourier transform-2D Discrete Fourier Transform and its inverse, Low-pass and high-pass filtering; Homomorphic filtering, selective filtering.

Unit III:

Morphological Image Processing: Erosion, Dilation, Opening, Closing, Hit or Miss Transformation, Boundary Extraction, Hole Filing.
Image Segmentation: Point, Line, edge detection; Edge detectors: Sobel, Prewitt, Canny; boundary detection; Thresholding techniques: global, local, Otsu's method; region-based segmentation.

Unit IV:

Image Compression: Image compression fundamentals, coding Redundancy. Compression models-Huffmann coding, run length coding, Bit Plane coding, and JPEG standards
Image restoration: Image degradation and restoration model, Types of Noise (Eg: Gaussian, salt & pepper, etc.); Noise removal methods – Mean filter, Median, Min, Max, Midpoint, Inverse filter, Wiener filter, Adaptive filters etc.

Unit V:

Feature Extraction and Object Recognition: Image representation: boundary descriptors, region descriptors, Texture analysis; Feature extraction: shape, color, texture features; Object recognition using template matching and statistical classifiers; Basics of machine learning and CNNs in image classification.

Course Outcomes:

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

1. Describe basic methods of image processing, video processing and their applications.

2. Performing image processing by application of various techniques like image enhancement, morphological processing, image Segmentation, compression, etc.
3. Interpret image and video processing algorithms.
4. Select, apply and use various algorithms in image and video processing applications.

Text Books:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Pearson Education, 3rd ed.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004
3. John Willam, K. Pratt, Digital Image Processing. Willey & Sons (3rd Edition).
4. S. Jayaraman, Digital Image Processing, McGraw Hill, 2012.
5. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach. Prentice Hall, 2011.

Reference Books:

1. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson, 2009.
2. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
3. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
4. Richard Szeliski, Computer Vision: Algorithms and Applications. Springer, 2010.

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01TH0603-4 Course: Customer Relationship Management
L: 3Hrs, P: 0Hrs, Per Week Total Credits: 3

Course Objectives

1. To make the students understand the organizational need, benefits and process of creating long-term value for individual customers.
2. To disseminate knowledge regarding the concept of Salesforce and Salesforce technologies.
3. To enable the students understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

UNIT I :

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

UNIT II :

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

UNIT III:

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

Unit IV:

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

UNIT V :

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

Course Outcomes:

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

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

Text Books

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

Reference Books

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

Program Elective-III

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0604-01 Course: Data Storage and Network in cloud

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Unit I: Introduction to Cloud Storage

Concepts in Cloud Storage, Types of Storage: Object Storage, Block Storage, File Storage, Differences among the different types of storage.

Unit II: Storage Services in AWS

Simple Storage Service (S3), Elastic Block Store (EBS), Elastic File Store (EFS), FSX, FSX Lustre, AWS Snowball, Snowmobile etc., Features of different storage services in AWS, perform various operations through the different storage services in AWS.

Unit III: Storage Services in Ms Azure

Binary Large Objects (Blobs), Block Blob, Page Blob, Append Blob; Azure Disks, Azure File Share etc., Features of different storage services in Azure, perform various operations through the different storage services in Azure.

Unit IV: Introduction to Networks in Cloud

Designing the Networks in On Premises environment, Concept of CIDR blocks, Subnet Masks etc. Designing the Networks in Cloud environment, Designing a custom Virtual Private Cloud (VPC) in AWS, Designing a custom Virtual Network in Ms Azure.

Unit V: Virtual Private Cloud (VPC) in AWS and Virtual Networks in Ms Azure

Introduction to VPC, Features of default and custom VPC, Subnets, Creating a VPC along with multiple Subnets, Route Tables, Internet Gateway, NAT Gateway, NAT Instances etc., Concept on Public and Private subnets, VPC Peering. Introduction to VNET, Features of default and custom VNETs, Subnets, Creating a VNET along with multiple Subnets, VNET Peering, VPN Gateway.

Course Outcomes

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

1. Differentiate between the different storage types
2. Understand and analyze storage services in AWS and Azure.
3. Analyze and deploy storage services on AWS and Azure platform.
4. Design and create the networks in cloud.
5. Understand and analyze the networking services in AWS and Azure.
6. Analyze and deploy networking services on AWS and Azure platform.

Text Books:

1. Practical AWS Networking, By Mitesh Soni, Packt Publication.

2. Azure Networking Cookbook, Second Edition - Second Edition, By Mustafa Toroman, Packt Publication.
3. AWS Storage Services: A complete guide to understanding storage services, IP Specialist - Companion Guide: First Edition – 2022
4. Microsoft Azure Storage: The Definitive Guide, Avinash Valiramani, Microsoft.
5. learn.microsoft.com

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0604-02 Course: Vulnerability Assessment and Penetration Testing

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives:

1. Learn about various hacking concepts and requirements of setting-up a penetration testing lab.
2. Learn to use Kali Linux and different penetration testing tools.
3. Explore advanced penetration testing concepts.

Unit I

Setting up virtual lab, Configuring the Network for Your Virtual Machine, Setting Up Android Emulators, Target Virtual Machines, Setting a Static IP Address, Setting up external servers, Using Kali Linux, Programming

Unit II

Tools of the trade, Using Metasploit Framework, Types of Shells, Msfcli, Creating standalone payloads, Information gathering, Red team recon, Finding Vulnerabilities, Capturing Traffic

Unit III

Exploitation, Exploiting WebDAV default credentials, Exploiting Open phpMyAdmin, Exploiting Third-party Web Applications, Exploiting NFS shares, Password attacks, Client-side exploitation - Browser, PDF, Java etc.

Unit IV

Social engineering, Mass email attacks, Multipronged attacks, Compromising the network, Bypassing anti-virus applications, Post exploitation, Privilege escalation, Lateral movement, Pivoting, Persistence

Unit V

Web application testing, Using BurpSuite, SQL injection, XPath injection, LFI, RFI, CSRF, XSS, Wireless attacks, Physical attacks, Stack-based buffer overflowin linux and windows, Known vulnerability in War-FTP, Locating & controlling EIP. Structured exception handler overwrites, Finding attack string in memory, Using a short jump, Fuzzing, Finding bugs with code review, Porting exploits, Replacing shellcode, Writing Metasploit modules, Exploitation mitigation techniques

Course Outcomes

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

1. Apply penetration testing concepts to network and applications.
2. Identify vulnerabilities in target technology and exploit them.
3. Carry out privilege escalation activities in breached networks.
4. Implement social engineering and physical attacking methods for penetration testing.
5. Design custom hacking scripts.

Textbooks:

1. Penetration Testing: A Hands-On Introduction to Hacking by Georgia Weidman|2014 Edition. No Starch Press.
2. The Hacker Playbook 3: Practical Guide to Penetration Testing by Peter Kim

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0604-03 Course: Natural Language Processing

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives

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

UNIT I

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

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

UNIT V

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

Course Outcomes

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

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

Textbooks

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

Reference Books

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

Syllabus for Semester VI B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0604-04 Course: System Design

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives:

1. To introduce reliable software systems.
2. The objective of this course is to equip students with the knowledge and skills required to design scalable, reliable, and maintainable software systems.
3. Illustrate the benefits and drive the adoption of solutions for industry based real world problems.

Unit I: Introduction to System Design, System Design fundamentals, System Design Life Cycle, components of System Design, Scalability in System Design and System design patterns.

Unit II: Databases in Designing Systems: Relational databases, Non-relational databases, How to choose a database, Database sharding and partitioning, Database indexing.

Unit III: Distributed system basics: Distributed system fundamentals, Distributed system failures, MapReduce Stateless and stateful systems, Distributed system design patterns

Unit IV: High level Design (HLD) and LLD (Low Level Design)

Unit V: Event management, message passing, log file , Scalable web applications, DNS and load balancing, N-tier applications, HTTP and REST, Stream processing, Caching, Machine learning and System Design, Containerization and System Design, The cloud and System Design

Course Outcomes

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

1. Understand the fundamental principles of system design including scalability, reliability, maintainability and performance.
2. Perform exceptional scenarios building using appropriate databases and Distributed system fundamentals.
3. Ability to Perform High level Low Level Design.
4. Ability to do Event management, message passing and load balancing.

Text Books:

1. System Design Interview Volume 1 and 2 by Alex Xu.
2. Designing Data-Intensive Applications, Martin Kleppmann.
3. Patterns of Enterprise Application Architecture 1st Edition by Martin Fowler.

Reference Books

1. Clean Architecture: A Craftsman’s Guide to Software Structure and Design, Robert C. Martin , Pearson.
2. Systems Analysis and Design, Scott Tilley, Cengage Learning.
3. System Analysis and Design, Alan Dennis, Barbara Wixom, Roberta M. Roth, Wiley.

Program Elective-IV

Syllabus for Semester VII B.Tech. Computer Science & Engineering

Course Code: 25CS01TP0702-01 Course: AL & ML for Public Cloud Platform

L: 2Hrs, P: 2Hrs, Per Week Total Credits: 3

Unit 1: Introduction to Artificial Intelligence and Azure AI Services

- Overview of Artificial Intelligence and Machine Learning
- AI in daily life and industry applications
- Introduction to Microsoft Azure
- Azure Cognitive Services overview
- Use cases of Azure AI services (vision, speech, language, decision-making)

Unit 2: Machine Learning on Azure

- What is machine learning? Types of ML: supervised, unsupervised, reinforcement
- Azure Machine Learning basics
- Create and run ML models using Azure ML Studio
- Data preprocessing, training, and deployment
- Hands-on: Build a basic regression/classification model using Azure ML

Unit 3: Computer Vision and Image Analysis

- Introduction to Computer Vision APIs
- Image classification, object detection, facial recognition
- OCR and form recognizer
- Hands-on: Use Azure Cognitive Services for image analysis

Unit 4: Natural Language Processing (NLP) and Conversational AI

- Text analytics: sentiment analysis, key phrase extraction
- Translator and language detection services
- Azure Bot Service and QnA Maker
- Hands-on: Build a chatbot using Azure Bot Framework and Language Studio

Unit 5: Responsible AI and AI-900 Exam Preparation

- Principles of responsible AI: fairness, reliability, privacy, security
- Challenges in deploying ethical AI solutions
- Cost management and monitoring in Azure AI
- AI-900 certification preparation and mock tests
- Final capstone project: Build and deploy a complete AI solution using Azure

Suggested Lab Exercises

- Create an ML model with Azure ML Studio
- Perform sentiment analysis on a dataset
- Build a facial recognition system with Computer Vision API
- Develop a multilingual chatbot using Azure Bot Services
- Apply content moderation and text translation APIs

Course Outcomes (COs):

1. Understand basic AI/ML concepts and real-world applications.
2. Explore Azure AI services including Computer Vision, NLP, and Conversational AI.
3. Apply machine learning concepts using Azure Machine Learning Studio.
4. Demonstrate use of responsible AI principles on Azure.
5. Prepare and qualify for the AI-900 certification with hands-on labs.

Text Books

1. **Microsoft Certified Azure AI Fundamentals Study Guide (Exam AI-900)** – Julian Sharp (Microsoft Press)
2. **Hands-On Azure for Developers** – Mustafa Toroman
3. **Artificial Intelligence: A Guide for Thinking Humans** – Melanie Mitchell

Reference Books and Resources

- Microsoft Learn AI-900 Learning Paths – https://learn.microsoft.com
- **Practical Artificial Intelligence with Azure** – Rabeb Othmani
- **Azure AI Fundamentals (AI-900) Exam Ref** – Jim Cheshire
- AI School by Microsoft – https://aischool.microsoft.com

Syllabus for Semester VII B. Tech. Computer Science & Engineering [SAP]

Course Code: 25CS01TP0702-02 Course: Computer Vision

L: 3Hrs, P: 2Hrs, Per Week Total Credits: 4

Course Objectives :

The objective of this course is to introduce foundational and advanced concepts of image processing and computer vision. Students will learn techniques for image formation, enhancement, feature extraction, segmentation, and pattern recognition, enabling them to analyze and interpret image data for real-world vision applications.

Unit I: Image Processing Foundations

Introduction to basic image processing techniques – Classical filtering operations – Thresholding techniques – Edge detection methods – Corner and interest point detection – Mathematical morphology – Texture analysis.

Unit II: **Image Formation and Processing**

Overview of image formation and processing – State-of-the-art methods – Fundamentals of image formation – Geometric transformations: Orthogonal, Euclidean, Affine, and Projective – Fourier Transform – Convolution and Filtering – Image enhancement and restoration – Histogram processing techniques.

Unit III: **Feature Extraction**

Edge detectors: Canny, LoG, DoG – Line detection using Hough Transform – Corner detection: Harris and Hessian Affine – Orientation histogram methods – Local descriptors: SIFT, SURF, HOG, GLOH – Scale-space analysis with image pyramids and Gaussian derivatives – Gabor filters and Discrete Wavelet Transform (DWT).

Unit IV: **Image Segmentation**

Segmentation using region growing and edge-based approaches – Advanced methods: Graph Cuts, Mean-Shift, Markov Random Fields (MRFs) – Texture-based segmentation – Introduction to object detection methods.

Unit V: **Pattern Analysis**

Clustering techniques: K-Means, K-Medoids, Mixture of Gaussians – Classification: Discriminant functions, Supervised, Unsupervised, and Semi-supervised learning – Classifiers: Bayes, K-Nearest Neighbors (KNN), Artificial Neural Networks (ANN) – Dimensionality reduction techniques: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Independent Component Analysis (ICA) – Non-parametric classification methods.

Course Outcomes

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

1. Apply foundational image processing operations including filtering, thresholding, and morphological analysis.
2. Understand and implement image formation models and geometric transformations.
3. Extract meaningful features from images using modern descriptors and scale-space analysis.
4. Perform image segmentation and object detection using classical and graph-based techniques.
5. Analyze and classify image data using pattern recognition and dimensionality reduction techniques.

Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011
2. T2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003

Reference Books

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, 2nd Edition, Cambridge University Press, 2004
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 200
3. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, 1992
4. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Edition, Academic Press / Morgan Kaufmann, 1990

Syllabus for Semester VII B. Tech. Computer Science & Engineering [SAP]
Course Code: 25CS01TH0702-03 Course: Fog Computing
L: 3Hrs, P: 0Hrs, Per Week Total Credits: 3

Course Objectives:
To provide foundational and practical knowledge of Fog Computing by exploring its architecture, middleware, communication protocols, and applications in IoT–Edge–Cloud integrated environments.

Unit I:
Introduction of Edge and Fog Computing: Internet of Things (IoT) and New computing paradigms, Fog computing: A platform for Internet of Things and analytics, Emergence of edge computing, Legal aspects of operating IoT applications in the fog. Edge Architecture: Multi-Tier cloud computing framework; Data services with clouds at home; Characteristics and features of Fog Computing, Benefits and Challenges of Fog Computing, Comparison: Cloud vs Edge vs Fog

Unit II:
Networking for Edge & Fog: Integrating IoT + Fog + Cloud Infrastructures: System modeling and research Challenges, Management and Orchestration of network slices in 5G, Fog, Edge, and Clouds, Real-time and Latency-sensitive Applications

Unit III:
System Design: Optimization problems in fog and edge computing, Middleware for fog and edge Computing: Design issues, A Lightweight container middleware for edge cloud architectures, Communication Protocols: MQTT, CoAP, HTTP, Resource Management and Scheduling in Fog Computing.

Unit IV:
Data Processing: Data management in fog computing, Predictive analysis to support fog application deployment, Using machine learning for protecting the security and privacy of Internet of Things (IoT) systems, fog Computing realization for Big data analytics, Open-source Tools for Fog Simulation: iFogSim

Unit V:
Applications and Case Studies: Fog computing realization for Big data analytics, Smart Cities and Transportation, Smart Healthcare Systems, Industrial IoT (IIoT) and Industry 4.0, Smart Agriculture and Environmental Monitoring, Smart Grid and Energy Management, Video Surveillance and Security Systems

Course Outcomes
On successful completion of the course, student shall be able to
1. Understand the concepts of Fog Computing and its architecture in comparison to Cloud and Edge Computing.
2. Design and evaluate integrated IoT–Fog–Edge–Cloud network architectures
3. Apply middleware design, communication protocols, and resource management strategies for efficient system design in fog computing
4. Apply data management, predictive analytics, and machine learning techniques in fog-based IoT systems.
5. Apply fog computing models and tools to real-world problems.

Text Books:

1. R. Buyya, S.N. Srirama, Fog and Edge Computing: Principles and Paradigms, Wiley-Blackwell
2. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya, Wiley

Reference Books

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing