|| Jai Sri Gurudev ||

Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

An AUTONOMOUS INSTITUTION UNDER VISVESVARAYA TECHNOLOGICAL UNIVERSITY

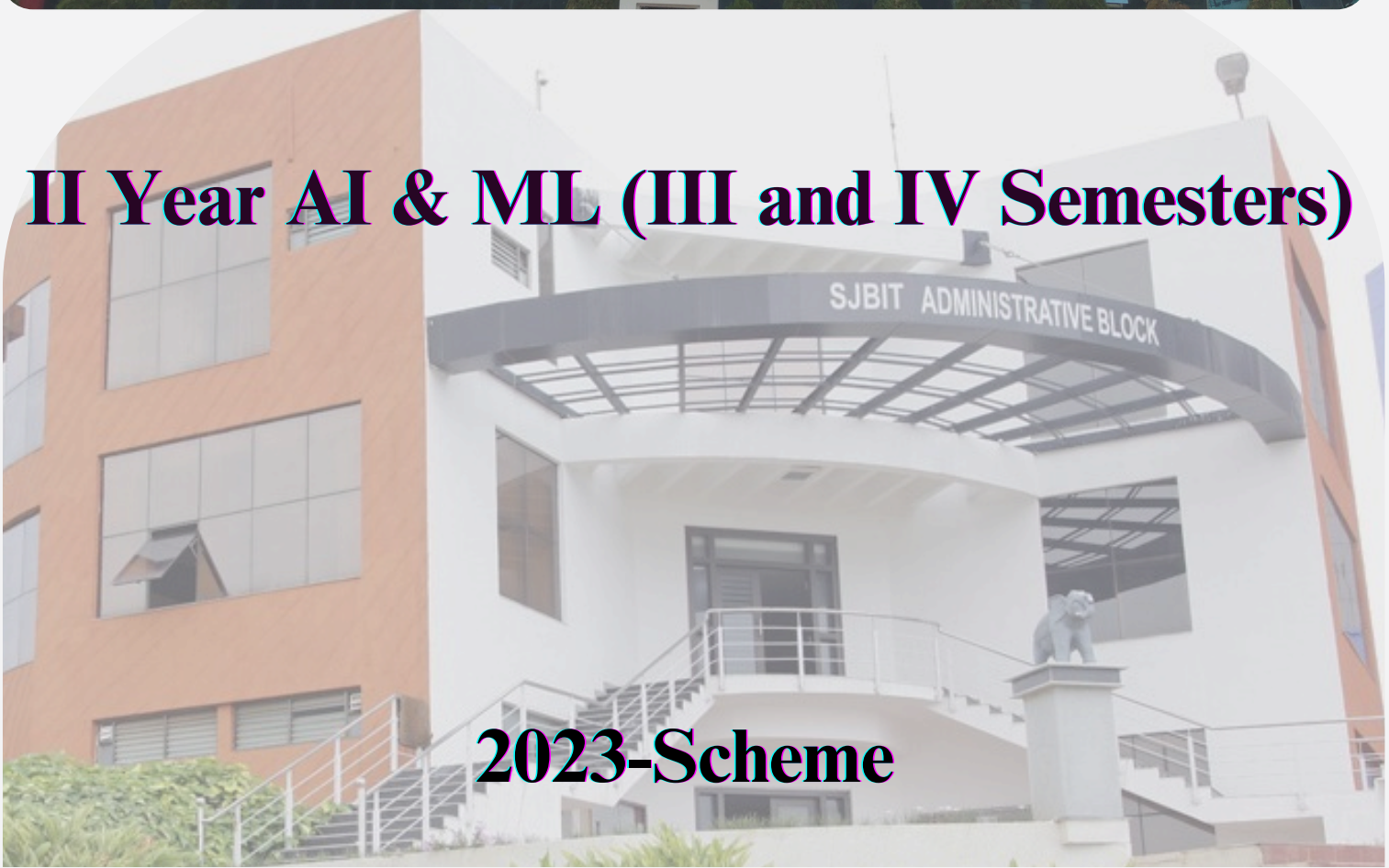
Approved by AICTE, 2(f) and 12(B) recognized by UGC, New Delhi
Accredited by NAAC, Accredited by NBA, Certified by ISO 9001 - 2015

Department of Artificial Intelligence and Machine Learning

BE

Autonomous Scheme & Syllabus

II Year AI & ML (III and IV Semesters)



2023-Scheme

SERVICE TO MANKIND IS SERVICE TO GOD

His Divine Soul Padmabhushana

Sri Sri Sri Dr. Balagangadharanath MahaSwamiji

Founder President, Sri Adichunchanagiri Shikshana Trust®

Belief in God is not ignorance or illusion. It is a belief that there is an unseen, ineffable Power that transcends all our powers of muscles, mind and lives.

His Holiness Parama Pujya

Sri Sri Sri Dr. Nirmalanandanatha MahaSwamiji

President, Sri Adichunchanagiri Shikshana Trust ®

True richness is the generosity of heart. Cultivate it and work to help the less fortunate ones in life.

Revered Sri Sri Dr. Prakashanatha Swamiji

Managing Director, BGS & SJB Group of Institutions & Hospitals

People and prosperity follow the path which the leaders take. So the elders and leaders should make sure that they give the right lead and take the right path.

Institution Vision:

To become a recognized technical education center with a global perspective.

Institution Mission:

To provide learning opportunities that foster students' ethical values, intelligent development in science technology and social responsibility so that they become sensible and contributing members of society

Department Vision:

To gain global acclaim by fostering excellence in education, research, and innovation, thereby creating leaders who influence society through technology.

Department Mission:

M1: Foster a comprehensive understanding of both the theory and application of Artificial Intelligence and Machine Learning.

M2: Establish a conducive learning environment that nurtures globally competitive skills.

M3: Nurture innovation and ethics, preparing students as responsible societal members.

2023 Scheme – UG

Syllabus for 3rd & 4th Semester

The syllabus, scheme and guidelines are provided in detail.
The syllabus, scheme and guidelines are subjected to changes if any needed.
The updates will be done timely.
Regularly access the institution website for the updated information.

The Syllabus book is available on	www.sjbit.edu.in
For any queries, please write to	academicdean@sjbit.edu.in

UPDATES

Release / Revision	Date	Remarks
Release	03/09/2024	First release

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Department of Artificial Intelligence & Machine Learning

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Sri Adichunchanagiri Shikshana Trust (R)

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 2nd Year Dept:AI & ML

SCHEME: 2023 **SEM: III** **Revision date: 23-Aug-2024**

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O	CIE Marks	SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL / SL/etc.		Dur.	Th.	Lab	Tot.
1	IBSC	3	23AII301	Discrete Mathematics and Graph Theory	Maths	Maths	4	2	2	2	@	50	03	50	-	100
2	PCC	1	23AIT302	Data Structures with Application	AI & ML	AI & ML	3	2	2	0		50	03	50	-	100
3	IPCC	1	23AII303	Logic Design & Computer Organization	AI & ML	AI & ML	4	3	0	2		50	03	50	-	100
4	IPCC	2	23AII304	Database Management Systems	AI & ML	AI & ML	4	3	0	2	@	50	03	50	-	100
5	PCCL	1	23AIL305	Data Structures Lab	AI & ML	AI & ML	1	0	0	2	@	50	03	-	50	100
6	ETC	1	23AIE31y	Emerging Technology Course - 1	AI & ML	AI & ML	3	3	0	0	@	50	03	50	-	100
7	AEC	3	23AIAE31	Data Visualization and Analysis with Power BI	I.E.	I.E.	1	1	0	0	3	50	02	50	-	100
8	NCMC	3	23PDSN03	Skilful Futures : Empowering Aptitude and Soft skills	I.E.	I.E.	**PP/NP**	0	0	0	2	50	-	-	-	50
9	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	**PP/NP**	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
						Total	**20**	**14**	**4**	**8**	**7**	**450**		**300**	**50**	**800**

BSC: Basic Science Course; PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; AEC: Ability Enhancement Course; {I.E.-Industry Experts};
{@ - Compulsory one activity}.
PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

ETC (Emerging Technology Course):

For ETC (L:T:P:O) can be plaanned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

NCMC (Non Credit Mandatory Course): The following guidelines are applicable for the course type series-4 as mentioned above.

1) All students must register for any one of the course with the department during the first week of the III semester.
2) Once registered for a course in the III semester, the student shall continue and complete the same course in the remaining semesters. No provision for changing the courses after registration.
3) Activities shall be carried out by the students between III semester to VI semester (for 4 semesters).
4) The activities shall be organized, executed and monitored by the concerned department as mentioned above in coordination with the department level course coordinators. The same shall be reflected in the calendar of events of the above concerned departments.
5) Successful completion of the registered course and requisite CIE score (PP) is mandatory for the award of degree.
6) These courses are not considered for vertical progression, calculation of SGPA & CGPA, however it is mandatory for the award of degree.
7) The guidelines is applicable to all the remaining IV to VI semesters.

Additional courses for Lateral Entry students:

1) The lateral entry students getting admitted from the 2nd year of programme, shall register, study and complete additional courses prescribed & offered time to time.
2) Successful completion of the registered course and requisite CIE score (PP) is mandatory for the award of degree.
3) These courses are not considered for vertical progression, calculation of SGPA & CGPA, however it is mandatory for the award of degree.

Self-Learning Courses (SLC) as per the VIII Semester ST&E:

1) Offering and Registration of Self-learning Courses will commence from 3rd Semester itself and continues till the end of the duration of study.
2) Both regular & lateral entry students shall start registering for the self learning courses and complete as per the guidelines published separately. (Refer to the Self Learning Courses guidelines published).
3) These courses are not considered for vertical progression.
4) Calculation of SGPA & CGPA is considered for VIII Semester, irrespective of period or time of completion of the course.

Emerging Technology Course - 1	
Course Code	**Course Title**
23AIE311	Object Oriented Programming with Java
23AIE312	Python for Data Science
23AIE313	Introduction to Big Data Analytics
23AIE314	Introduction To Cyber Security

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AUTONOMOUS SCHEME (Tentative) UG - BE 2nd Year 2024

SCHEME: 2023 **Date of release: 29/06/2024**

SEM: III **Additional courses for Lateral Entry students**

Note:

1) For the fulillment of successful completion of degree, lateral entry students, shall study & complete additional courses as per the guidelines released time to time.
2) Regular courses (SL No 1 to 8) are same as applicable to all defined in the scheme of teaching & examinations (ST&E).
3) The below prescribed courses has to be registered whenever they are offered and successfully completed before the end of Seventh Semester End Examinations.

SL No	Course Type	Course type Count	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	S	CIE Marks	SEE			
								Lecture	Tutorial	Practical	PBL/ABL/ SL/othrs.		Dur.	Th. Mrks	Lab. Mrks.	Tot. Marks
For CS stream (CSE/ISE/AIML/CSE(DS))																
9	BSC	-	23MAT31A	Additional mathematics-1	Maths	Maths	**PP/NP**	2	0	0	@	50	-	-	-	50
For EE stream (ECE & EEE)																
9	BSC	-	23MAT31B	Additional mathematics-1	Maths	Maths	**PP/NP**	2	0	0	@	50	-	-	-	50
For CV stream (Civil)																
9	BSC	-	23MAT31C	Additional mathematics-1	Maths	Maths	**PP/NP**	2	0	0	@	50	-	-	-	50
For ME stream (Mechanical)																
9	BSC	-	23MAT31D	Additional mathematics-1	Maths	Maths	**PP/NP**	2	0	0	@	50	-	-	-	50

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Self Learning course list for UG BE Dept:AI & ML

SCHEME :	2023	Release date:	22-May-2023

Self-Learning course - 1 (NPTEL)			Self-Learning course - 2 (NPTEL)		
Course Code	Course Title	NPTEL Code	Course Code	Course Title	NPTEL Code
23AIS101	Artificial Intelligence : Search Methods For Problem Solving	106106226	23AIS201	Artificial Intelligence: Knowledge Representation and Reasoning	106106140
23AIS102	Learning Analytics Tools	106101224	23AIS202	Deep Learning for Computer Vision	106106224
23AIS103	Games and Information	106101360	23AIS203	Affective Computing	106106244
23AIS104	Linear programming and its applications to computer science	106104356	23AIS204	Artificial Intelligence: Knowledge Representation and Reasoning	106106140
23AIS105	AI: Constraint Satisfaction	106106158	23AIS205	Games and Information	106101360
23AIS106	Advanced R Programming for Data Analytics in Business	noc24-mg113	23AIS206	Algorithmic Game Theory	noc24-cs109
23AIS107	Computer Architecture	noc24-cs83	23AIS207	Distributed Optimization and Machine Learning	noc24-cs86
23AIS108	Matrix Computation and its Applications	noc24-ma88	23AIS208	Practical Cyber Security for Cyber Security Practitioners	noc24-cs85
23AIS109	Software Testing	noc24-cs91	23AIS209	Responsible & Safe AI Systems	noc24-cs132
23AIS110	Probability Theory for Data Science	noc24-ma64	23AIS210	Advanced Distributed Systems	noc24-cs99

Guidelines for Self-learning courses – Under Graduation (UG)

1) As per the Scheme of Teaching & Examinations (ST&E) the UG students to earn totally 06 credits by studying and completing 02 NPTEL/SWAYAM courses of 12 weeks each earning 03 credits.
2) The credits so earned by successful completion of the courses will be credited in the 8th SEM grade card.
3) The successful completion of the courses means earning of the course completion certificates from NPTEL/SWAYAM.
4) The courses shall be studied and completed starting from 3rd Semester and shall be completed before the announcement of 8th Semester End Examinations. However, it is advised to complete both the courses before the 7th SEM of their graduation.
5) The respective department BOS shall identify the professional courses related to the respective discipline either core or multidisciplinary from the list of courses released by NPTEL/SWAYAM every season. At least ten such courses shall be identified and finalized after the discussions in the respective BOS meetings, and the list shall be approved by the Academic Dean.
6) The approved list shall be published by the departments to the students at the beginning of the 3rd SEM itself and the student shall be given an option to choose up to 02 courses for the study and earn certificates of completion.
7) The practicing of studying and completion of NPTEL/SWAYAM courses starting from 3rd SEM itself has multi-fold effect:
   i) Enhances the self-learning ability of the students.
   ii) Study of self-learning courses will have impact on the learning of other courses in the scheme of teaching & examinations.
   iii) Will address the real time challenges/difficulties/differences in the calendars of NPTEL/SWAYAM & Institution.
8) The respective departments shall make holistic efforts to bring awareness to the students about the objectives and importance of self-learning courses. The departments shall thrive towards fulfilment of the objectives.
9) The departments shall continuously monitor & track the progress of the accomplishment of the courses by the students.
10) The departments shall assign course mentors as per the guidelines of the NPTEL/SWAYAM.

11) The departments shall take care that the registered courses and the examinations shall be under the local chapter of the Institution.
12) Every care must be taken by the departments to guide, motivate, to help the students in completing the courses as the academic calendar of the institution and the calendar of the NPTEL/SWAYAM does not match. The faculty advisory system or Mentor System must play a significant role.
13) Every season new courses may be added to the identified list and a fresh list of courses shall be prepared based on the list announced by the NPTEL/SWAYAM every season. However, the courses published from the first list shall be maintained if the NPTEL/SWAYAM list has the courses.
14) If the students are unable to successfully complete the course, they shall be given an option to re-register for the same course multiple times if the courses are available during the respective seasons in NPTEL/SWAYAM list.
15) An option for making fresh choice shall be given to the students until the successful completion of the courses and earning of required number of credits within the defined time.
16) The list of students registered for the courses and completion of the courses shall be submitted to the dean office on completion of every season.
17) All the regulations such as "Dropping of courses", "Withdrawal of Courses", etc. as described in the academic regulations shall be applicable to the Self Learning Courses (SLC).
18) The performance of the students in the assignments and the certification exam of the NPTEL/SWAYAM shall be considered for awarding the grade points to the students in the self-learning courses.
19) If the students are successfully completing more than the prescribed number of courses in their period of study, best performed courses (group wise) may be considered for the award of credits.
20) The CIE & SEE marks as prescribed in the Scheme of Teaching & Examinations (ST&E) shall be considered as per the performance of the student in the successfully completed NPTEL/SWAYAM course. The obtained assignment marks in the successfully completed NPTEL/SWAYAM course shall be mapped to the CIE and obtained exam certification percentage in the successfully completed NPTEL/SWAYAM course shall be mapped for SEE marks.
21) The students unable to complete the self-learning courses and earn the required credits will not be awarded the degree. Degree shall be awarded only after successful completion and earning of credits.

Academic Dean
Dr. Babu N V

Principal
Dr. K V Mahendra Prashanth

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 2nd Year Dept:AI & ML

SCHEME: 2023 **SEM: IV** **Revision date: 23-Aug-2024**

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O	CIE Marks	SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL / SL/etc.		Dur.	Th.	Lab	Tot.
1	BSC	4	23AIT401	Probability Distributions and Statistical Methods	Maths	Maths	3	2	2	0	@	50	03	50	-	100
2	PCC	2	23AIT402	Analysis & Design of Algorithms	AI & ML	AI & ML	3	3	0	0		50	03	50	-	100
3	IPCC	3	23AII403	Introduction to Artificial Intelligence	AI & ML	AI & ML	4	3	0	2		50	03	50	-	100
4	IPCC	4	23AII404	Operating Systems	AI & ML	AI & ML	4	3	0	2		50	03	50	-	100
5	PCCL	2	23AIL405	Analysis & Design of Algorithms Lab	AI & ML	AI & ML	1	0	0	2	@	50	03	-	50	100
6	ETC	2	23AIE42y	Emerging Technology Course - 2	AI & ML	AI & ML	3	3	0	0	@	50	03	50	-	100
7	HSMC	5	23SFHH06/ 23UHVH07	Bioscience or UHV-Universal Human Values	any dept	any dept	1	0	2	0	@	50	02	50	-	100
8	AEC	4	23AIAE41	Azer AI	I.E.	I.E.	1	1	0	0	3	50	02	50	-	100
9	NCMC	5	23PDSN04	Mindful Mastery: Aptitude and soft skill integration	I.E.	I.E.	PP/NP	0	0	0	2	50	-	-	-	50
10	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	PP/NP	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
Total							**20**	**15**	**4**	**6**	**7**	**500**		**350**	**50**	**900**

BSC: Basic Science Course; PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; AEC: Ability Enhancement Course; HSMC: Humanities, Social Sciences & Management Course; NCMC: Non Credit Mandatory Course;
{@ - Compulsory one activity during the semester}
{I.E.-Industry Experts}.
PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

ETC (Emerging Technology Course):

For ETC (L:T:P:O) can be plaanned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

Bioscience & UHV-Universal Human Values:

1) Any one of the course will be offered by the departments in each semester of IV & VI based on the institutional planning.
2) Both the courses shall be studied and completed by the students registering each in the two semesters. For example, if Bioscience is offered in the IV semester, UHV-Universal Human Values is offered in the V semester.

NCMC (Non Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Emerging Technology Course - 2	
Course Code	**Course Title**
23AIE421	Advanced Java & J2EE
23AIE422	Introduction to Tensorflow
23AIE423	Business Intelligence
23AIE424	Blockchain Technology

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

III SEM Syllabus

(2023 Scheme)

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Department of Mathematics

Semester:	III	**Course Type:**	IBSC		
Course Title: Discrete Mathematics and Graph Theory					
Course Code:	**23AII301**			**Credits:**	4
Teaching Hours/Week (L:T:P:O)			2:2:2:@	**Total Hours:**	40+(10 –12 lab slots)
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3

I. Course Objectives:

This course will enable students to :

- Provide theoretical foundations of computer science to perceive other courses in the programme.
- Illustrate applications of discrete structures: logic, relations, functions and graphs.
- Describe different mathematical counting techniques.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, innovative teaching methods shall be adopted.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Grading assignments and quizzes and documenting student's progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

III(a) Theory Part

Module-1: Fundamentals of Logic	8Hrs

Fundamentals of Logic: Propositions- Logical connectives, Tautologies, contradictions. Logical equivalence- The Laws of Logic, inverse, converse and contra positive. Logical Implication – Rules of Inference, Quantifiers- Types and uses of quantifiers.
Applications to verify the algorithm using Mathematical logic.
*** Application problems to be excluded for SEE.**
Textbook 2: Chapter 1(1.1, 1.2, 1.3, 1.5).
Self Learning: Applications to switching Networks.

RBT Levels: L1, L2 and L3

Module-2: Principles of counting	8Hrs

Well ordering principle and Mathematical Induction.
Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.
Applications to design algorithms.
*** Application problems to be excluded for SEE.**

Textbook 1: Chapter 4(4.1), Chapter 1(1.1 to 1.4). **Self Learning:** The Catalan Numbers.	
RBT Levels:L1, L2 and L3	
Module-3: Relations and Functions	8Hrs
Relations and Functions: Cartesian products and Relations, Functions – plain and one-to-one, onto functions. Function Composition and Inverse functions(without proof). **Relations:** Properties of Relations, Computer Recognition – Zero-one matrices and Directed graphs, Partial orders – Hasse diagrams, Equivalence relations and Partitions. Applications to map inputs to outputs in algorithms and represent the relation between the nodes. *** Application problems to be excluded for SEE.** **Textbook 1:** Chapter 5.1, 5.2, 5.6 **Self Learning:** Sterling numbers of second kind, Pigeonhole principle, Topological Sorting.	
RBT Levels: L1, L2 and L3	
Module-4: Fundamentals of Graph Theory	8Hrs
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements and Graph Isomorphism. Vertex degree: Euler trails and circuits, planar graphs .Graph coloring and chromatic polynomials. Illustrative examples on Traveling salesman problem. *** Illustrative examples to be excluded for SEE.**	
Textbook 1: Chapter 11.1, 11.2, 11.3, 11.4, 11.6.	
Self Learning: Hamiltonian paths and cycles.	
RBT Levels: L1, L2 and L3	
Module-5: Trees and Connectivity	8Hrs
Trees – properties, pendant vertex, Distance and centers in a tree - Rooted and binary trees, counting trees, traversals, spanning trees. Connectivity Graphs: Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, separability, Menger's Theorem, Fundamental circuits. Application to organizing and searching data. *** Application problems to be excluded for SEE.** **Textbook 3:** Chapter 3.1 to 3.8, 4.1 to 4.5. **Self Learning:** Matchings ,Coverings.	
RBT Levels: L1, L2 and L3	

III(b) Practical Part

Using python/MATLAB software, demonstrate the operation of the following.

Sl. No.	Experiments
1	Program on logical connectives (AND, OR, NOT, XOR).
2	Check whether the given proposition is a tautology or not.
3	Compute the sum of first n odd numbers using mathematical induction.
4	Calculation of Permutation and combination.
5	Implement functions to check whether a given function is one-to-one and onto (Example: $f(x)=x^2$).
6	Check whether the relation is equivalence or not.
7	Implement the Fibonacci sequence using both an iterative approach and a recursive approach.
8	Program to verify a given relation forms a partial order or not. [Example: elements = [1, 2, 3, 4], Relation = [(1, 1), (1, 2), (2, 2), (2, 3), (3, 3), (3, 4), (4, 4)]].
9	Program on assign colors to the vertices of a graph, no two adjacent vertices share the same color.
10	Implement the Traveling Salesman Problem (TSP) using a Hamilton Path approach to find the shortest Hamilton Path in a weighted graph.
11	Write a program to find the maximum number of edge-disjoint paths between two vertices. Use the Edmonds-Karp algorithm, an implementation of the Ford Fulkerson method for computing the maximum flow in a flow network.
12	Using Menger's theorem, find the minimum vertex cut between source and target.

IV. COURSE OUTCOMES

The student will be able to:

CO1	Illustrate the basic concepts of mathematical logic and Graph theory.
CO2	Apply the knowledge of mathematical logic ,counting principles, Relations and functions, Graph theory to compute problems in various fields of Engineering.
CO3	Analyse the solutions of problems using mathematical logic and graphical techniques.
CO4	Develop the programs and algorithms on discrete mathematical structure and graphs.

V. CO-PO-PSO MAPPING (Mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	3	2	1		2							1	1	1	1
CO2	3	2	1		2							1	1	1	1
CO3	3	2	1		2							1	1	1	1
CO4	3	2	1		2							1	1	2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer CIE and SEE guidelines based on course type for autonomous scheme 2023

Continuous Internal Evaluation (CIE): Refer annexure section 2

Semester End Examination (SEE): Refer annexure section 2

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Name of the publisher**	**Edition and Year**
1	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	Pearson Education	5th Edition 2020
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw Hill	8th Edition 2021
3	Graph Theory With Application to Engineering and Computer Science	Narsingh Deo	Prentice Hall of India	Latest edition 2016
VII(b): Reference Books:				
1	Discrete Mathematical Structures: Theory and Applications	D.S. Malik and M.K. Sen	Cengage Learning	4th Edition 2010
2	Discrete Mathematics with Applications	Thomas Koshy	Elsevier	5th Edition Reprint 2018
3	Introduction to graph theory	Douglas B. West	Prentice Hall	3rd Edition 2014
VII(c): Web links and Video Lectures (e-Resources):				
1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.class-central-central.com/subject/math(MOOCs) 3. http://academiccarth.org/ VTU EDUSAT programme-20				
VIII: Activity Based Learning				
Assignments, Quiz, Presentation.				

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	PCC		
Course Title: Data Structures with Application					
Course Code:	23AIT302			**Credits:**	3
Teaching Hours/Week (L: T: P: O) {O – Other pedagogies, mention @}			2:2:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3.00 Hrs

Pre prerequisite: Programming using C

I. Course Objectives:

- To explain the fundamentals of data structures and their applications essential for implementing solutions to problems.
- To illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
- To develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists.
- To explore usage of Trees and Graph for application development.
- To apply the hashing techniques in mapping key value pairs.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

III. COURSE CONTENT

Module-1: Introduction	8 Hrs

Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations (Traversing, inserting, deleting, searching, and sorting). Review of Arrays. Structures: Array of structures Self-Referential Structures. Dynamic Memory Allocation Functions. Demonstration of representation of Polynomials and Sparse Matrices with array.
Textbook1:Chapter1:1.2, Chapter2:2.3-2.5, **Textbook2**: Chapter1:1.1-1.4,

RBT Levels: L1, L2, L3

Module-2: Linear Data Structures: Stack and Queues	8 Hrs

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different representation of expression. Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion. **Queues:** Definition, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays, Dequeues, Priority Queues.
Textbook1: Chapter 3: 3.1-3.4, 3.6

RBT Levels: L1,L2,L3

Module-3: Linked Lists	8 Hrs

Linked Lists: Definition, classification of linked lists. Representation of different types of linked Lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queue Applications of Linked lists–Polynomials, Sparse matrix representation. Programming Examples.
Textbook1: Chapter 4: 4.1–4.4,4.5.2,4.7,4.8

RBT Levels: L1, L2, L3

Module-4: Trees	8 Hrs

Trees: Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression. AVL Tree and Red black tree.
Textbook1: Chapter 5:5.1–5.3,5.5,5.7

RBT Levels: L1, L2, L3

Module-5: Graphs	8 Hrs

Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Hashing**:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing, collision resolution techniques.
Textbook 1: Chapter6: 6.1–6.2.1,6.2.2, Chapter 8:8.1-8.3

RBT Levels: L1, L2, L3

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain various data structures and their practical applications.
CO2	Apply stack and queue concepts effectively to solve problems.
CO3	Demonstrate the practical applications of linked lists in real-world scenarios.
CO4	Analyze Tree Data Structure to solve practical problems.
CO5	Apply graph and hashing techniques proficiently to handle key-value pairs and resolve collisions.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3		1		1						1	1	2			
CO2	2	2	1	2	1						1	1	2			
CO3	1	1	1	1	1						1	1	2			
CO4	1	1	2	1	2						1	1	2			
CO5	1	2	2	1	1						1	1	2			

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

VI. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Fundamentals of Data Structures in C	Ellis Horowitz and Sartaj Sahni	Universities Press	2ndEd,2014

VII(b): Reference Books:

1	Handbook of Data Structures and Applications,	Dinesh P Mehta, and SartajSahni	2nd edition ,28 October 2004	Chapman and Hall/CRC
2	Data Structures using C	Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein	Fifth Edition 2007	Pearson Education
3	Data Structures: A Pseudo code approach with C	Gilberg and Forouzan	2nd Ed, 2014	Cengage Learning
4	An Introduction to Data Structures With Applications	Jean Paul Tremblay & Paul G. Sorenson	2nd Ed, 2013	McGraw Hill

VII(c): Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses/106103069
- www.nptel.iitm.ac.in/video.php?subjectId=106105085
- www.cse.unt.edu/~rada/CSCE3110/Lectures/Trees.ppt
- www.nptel.iitm.ac.in/video.php?subjectId=106105085
- cslibrary.stanford.edu/103/LinkedListBasics.pdf
- https://aa.bbs.tr/lab /cen215-datastructures/DataStructures-Using-C2nd-edition.pdf

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	IPCC		
Course Title: Logic Design & Computer Organization					
Course Code:	**23AII303**			**Credits:**	04
Teaching Hours/Week (L: T: P: O)			3:0:2:0	**Total Hours:**	40+8-10 slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

Pre prerequisite: basic electronics, programming fundamentals, computer basics, and digital logic,

I. Course Objectives:

- To demonstrate the functionalities of the binary logic system.
- To explain the workings of combinational and sequential logic systems.
- To understand the basic structure of a computer system.
- To illustrate the workings of I/O operations and the processing unit.

II. Teaching-Learning Process:

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources□ LCD/Smart Boards □ Stud. Seminars

III COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to Digital Design	**8 Hrs**

Introduction to Digital Design: Binary Logic, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates, The Map Method, Four-Variable Map, Don't-Care Conditions NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit.

Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9.

RBT Levels: L1, L2, L3	
Module-2: Combinational Logic	**8 Hrs**
Combinational Logic: Introduction to Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Encoders, Multiplexers, **HDL Models of Combinational Circuits**: Adder, Multiplexer, Encoder. **Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12.**	
RBT Levels: L1, L2, L3	
Module-3: Sequential Logic	**8 Hrs**
Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops, Shift Registers, Types of Registers, Applications of Shift Registers, Counter, Asynchronous and Synchronous Counters, Mod -N Counter **Text book 1: 5.1, 5.2, 5.3, 5.4.**	
RBT Levels: L1, L2, L3	
Module-4: Basic Structure of Computers	**8 Hrs**
Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance –Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. **Textbook 2: Chapter: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5**	
RBT Levels: L1, L2, L3	
Module-5: Input/Output Organization	**8 Hrs**
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices. **Basic Processing Unit:** Some Fundamental Concepts, Register Transfers, Performing ALU operations. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance **Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1, 7.1, 7.2, 8.1**	
RBT Levels: L1, L2, L3	

III(b). PRACTICAL PART.

Sl. No.	Experiments
	PART-A
1	**Given Simplifying a 4-Variable Logic Expression:** • To simplify a 4-variable logic expression, you can use techniques such as Karnaugh maps or the Quine-McCluskey method. • **Karnaugh Maps (K-Maps):** K-maps help simplify Boolean expressions by grouping adjacent cells with the same output value. You can create a 4-variable K-map and identify groups to obtain a simplified expression • **Quine-McCluskey Method:** This method involves tabulation and prime implicants to minimize Boolean functions with more than 4 input variables. • **Once you've simplified the expression, you can simulate it using basic gates.**
2	**Designing a 4-Bit Full Adder and Subtractor:** • A 4-bit full adder adds two 4-bit numbers and produces a 4-bit sum along with a carry-out. • A 4-bit subtractor subtracts one 4-bit number from another and produces a 4-bit difference along with a borrow-out. • **You can design these circuits using basic gates (AND, OR, XOR, etc.) and simulate them.**
3	**Verilog HDL for Simple Circuits:** • You can implement simple circuits in Verilog HDL using different modeling styles • **Structural Modeling**: Describes the circuit using interconnected modules (gates, flip-flops, etc.). • **Data Flow Modeling:** Describes the circuit behavior based on data flow (assign statements, continuous assignments).

	• **Behavioral Modeling:** Describes the circuit behavior using procedural blocks (always, initial blocks). • **Choose the appropriate modeling style based on your requirements.**
4	**Verilog HDL for Binary Adder-Subtractor:** • Implement both half adder and full adder circuits in Verilog HDL, • Combine them to create a binary adder-subtractor that can perform addition or subtraction based on control signals. • Simulate the design using basic gates.
5	**Verilog HDL for Decimal Adder:** • Design a Verilog module that adds two decimal numbers (BCD representation) and produces the decimal sum. • Use basic gates and simulate the circuit.
6	**Verilog Program for Multiplexers:** • Create Verilog modules for 2:1, 4:1, and 8:1 multiplexers. • Implement them using basic gates and simulate their behavior.
7	**Verilog Program for De-Multiplexers:** • Design Verilog modules for different types of de-multiplexers (1:2, 1:4, etc.). • Simulate their functionality.
8	**Verilog Program for Flip-Flops:** • Implement Verilog modules for SR, JK, and D flip-flops. • Simulate their behavior using basic gates.

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

COURSE OUTCOMES

CO1	Apply K-Map techniques to efficiently simplify Boolean expressions.
CO2	Design different types of combinational and sequential circuits along with Verilog programs.
CO3	Describe the fundamentals of machine instructions, addressing modes, and processor performance.
CO4	Explain the approaches involved in achieving communication between the processor and I/O devices.
CO5	Analyze the internal organization of memory and the impact of cache/pipelining on processor performance.

II. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	1		1							1	1			1
CO2	3	2	2		1							1		2		
CO3	3	2	1		1							2			1	1
CO4	3	2	1		1							1		1		
CO5	3	2	1		1							1			2	1

III. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 2

Continuous Internal Evaluation (CIE): Refer Annexure-1section 2

Semester End Examination (SEE): Refer Annexure-1 section 2

IV. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher

1	Digital Design with an Introduction to Verilog Design,	M. Morris Mano & Michael D. Ciletti	5th Edition	Pearson Education.
2	Computer Organization	Carl Hamacher, Zvonko Vranesic, SafwatZaky,	5th, Edition	Tata McGraw Hill

VII(b): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Digital Principles and Design	Donald D. Givone	1st Edition, 2002	Tata McGraw-Hill Publishers, ISBN: 9780070529069.
2	Computer Organization and Architecture Designing for Performance,	William Stallings	11th Edition, 2019	Pearson, ISBN 9780134997193.
3	Logic and Computer Design Fundamentals	M. Morris Mano Charles Kime	4th Edition 2014	Pearson, ISBN 13: 978-1-292-02468-4.
4	Digital Design and Computer Architecture	David M Harris, Sarah L Harris	2nd Edition,2013	Elsevier Morgan Kaufmann Publishers, ISBN: 978-0-12-394424-5.

VII(c): Web links and Video Lectures (e-Resources):

- https://cse11-iiith.vlabs.ac.in/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes, Seminar and also, assign the group task to design the various types of counters and display the output accordingly

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	IPCC		
Course Title: DATABASE MANAGEMENT SYSTEM					
Course Code:	**23AII304**			**Credits:**	04
Teaching Hours/Week (L: T: P: O)			3:0:2:0	**Total Hours:**	40+8-10 slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3
Pre prerequisite: Fundamentals of Computer					

I. Course Objectives:

- To Provide a strong foundation in database concepts, technology, and practice.
- To Practice SQL programming through a variety of database problems.
- To Understand the relational database design principles.
- To Design and build database applications for real world problems.
- To Understand the basic concepts of NOSQL.

To become familiar with database storage structures and access techniques

II. Teaching-Learning Process:

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources□ LCD/Smart Boards □ Stud. Seminars

III COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to DBMS	**8 Hrs**

Introduction to databases: Definition, characteristics, advantages of DBMS approach compared to traditional file systems. Different types of database users.

Overview of database languages and architectures: Data models, schemas and instances, three-schema architecture, data independence, Data Languages and Interfaces, Database System Environment.

Conceptual Data Modeling using Entity-Relationship (ER) Model: Entities, attributes, relationships, cardinality, ER diagrams. **Textbook 1:Ch 1.1 to 1.6; 2.1 to 2.4; 3.1 to 3.9**
RBT Levels: L1, L2, L3

Module-2: Relational Model	**8 Hrs**

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas,Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate,grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **Textbook 1: Ch 5.1 to 5.3; Ch 8.1 to 8.5; Ch 9.1 to 9.2**
RBT Levels: L1, L2, L3

Module-3: Database Design	**8 Hrs**

Normalization: Informal design guidelines for relation schema, Functional Dependencies, Introduction to normalization concepts (1NF, 2NF, 3NF, BCNF), Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Transaction Management and concurrency Control **Textbook 1: Ch 14.1 to 14.7, Ch 20.1 to 20.3, 21.1, 22.1**
RBT Levels: L1, L2, L3

Module-4: SQL	**8 Hrs**

SQL: SQL data definition and data types, Constraints in SQL, Basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, **Advanced Queries**: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Textbook 1: Ch 6.1 to 6.4; Ch 7.1 to 7.4**
RBT Levels: L1, L2, L3

Module-5: Introduction to NOSQL-MongoDB	**8 Hrs**

NoSQL Databases: A High-Level View: Introduce the concept of NoSQL databases and their benefits compared to relational models, The CAP theorem, Document-Based NOSQL Systems and MongoDB (Overview of MongoDB, MongoDB CRUD Operations and Querying), NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases. **Textbook 1: Ch 24.1 to 24.6**
RBT Levels: L1, L2, L3

III(b). PRACTICAL PART.

Sl. No.	**Experiments**
	PART-A
1	Create a table called Student & execute the following. Student (USN, SNAME, PROGRAM_NAME, DOB, CLASS) 1. Create a user and grant all permissions to the user. 2. Insert a new student. 3. Change the class of student 'Smith' to '4-AIML'. 4. Delete the record for the student whose name is 'Smith' and student number is 17. 5. Alter SNAME to STUDENT NAME
2	Queries using aggregate functions (COUNT, AVG, MIN, MAX, SUM), Group by, Order by. Employee (E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employee table 3. Find the Maximum age from employee table. 4. Find the Minimum age from employee table.

	5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.
3	Create a table called Student & execute different join operations (INNER, LEFT, RIGHT, FULL). Student table: (Student_ID, Name, Age, Major, GPA) Course table: (Course_ID, Course_Name, Credits) Enrollment table: (Student_ID, Course_ID, Semester, Grade)
4	Consider the schema for College Database: STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) SUBJECT (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1JB19CS101' in all subjects. 4. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak'
5	Install an Open-Source NoSQL Data base MangoDB & perform basic CRUD (Create, Read, Update & Delete) operations. Execute MangoDB basic Queries using CRUD operations
PART-B	
	A team of 4 students develop database system for any problem selected; make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

COURSE OUTCOMES

CO1	Apply the fundamental concepts of databases and DBMS.
CO2	Design and implement relational databases using the Entity-Relationship model.
CO3	Apply SQL for creating, manipulating, and retrieving data from relational databases.
CO4	Apply normalization techniques to design efficient and effective database schemas.
CO5	Explain the concept of NOSQL.

II. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2			3							3	3			
CO2	3	3	2		3				2			3	3			
CO3	3	3	3	2	3	3			3		3	3	3			
CO4	3	3	3	2	3				3			3	3			
CO5	3	3	3	2	3	3			3		3	3	3			

III. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 2

Continuous Internal Evaluation (CIE): Refer Annexure-1section 2

Semester End Examination (SEE): Refer Annexure-1 section 2

IV. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Fundamentals of Database Systems	Ramez Elmasri and Shamkant B. Navathe	7th Edition, 2017,	Pearson
2	Database management systems	Ramakrishnan, and Gehrke	3rd Edition, 2014	McGraw Hill

VII(b): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Database Systems Concepts	Abraham Silberschatz, Henry K. F. Wong, and Michael Stonebraker	7th Edition	McGraw Hill

VII(c): Web links and Video Lectures (e-Resources):

https://www.coursera.org/learn/relational-database
https://www.udacity.com/course/intro-to-relational-databases--ud197
https://www.w3schools.com/sql/
https://www.tutorialspoint.com/dbms/index.htm
https://onlinecourses.nptel.ac.in/noc22_cs91/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes, Seminar and Mini Project

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	**PCCL**		
Course Title: Data Structures Lab					
Course Code:	23AIL305			**Credits:**	1
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			0:0:2:0	**Total Hours:**	20.00
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Practical**			**Exam Hours:**	3.00
Pre-Prerequisite: Programming using C					

I. Course Objectives:

- To learn the fundamental types of data structures, their implementation, and their applications.
- To understand the significance of using appropriate data structures for effective programming.
- To develop the ability to identify suitable data structures in problem-solving.

II. Teaching-Learning Process (General Instructions):

- Implement all the programs in "C" Programming Language and Linux OS.

PART-A

Sl. No.	List of Laboratory Experiments
1	Design, Develop and Implement a menu driven Program in C for the following Array operations ➢ Inserting an Element (ELEM)at a given valid Position (POS) ➢ Deleting an Element at a given valid Position (POS) ➢ Display of Array Elements ➢ Exit. Support the program with functions for each of the above operations.
2	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
3	Design, Develop and Implement a programming C for the following Stack Applications Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ Solving Tower of Hanoi problem with n disks.
4	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) ➢ Insert an Element on to Circular QUEUE ➢ Delete an Element from Circular QUEUE ➢ Demonstrate Overflow and Underflow situations on Circular QUEUE ➢ Display the status of Circular QUEUE ➢ Exit Support the program with appropriate functions for each of the above operations
5	Singly Linked List (SLL)of Integer Data ➢ Create SLL stack of N integer. ➢ Display of SLL ➢ Linear search.

	Create a SLL queue of N Students Data Concatenation of two SLL of integers.
6	Design, Develop and Implement a menu driven Programming C for the following operations on Binary Search Tree (BST) of Integers ➢ Create a BST of N Integers ➢ Traverse the BST in In-order, Preorder and Post Order
7	Design, Develop and implement a program in C for the following operations on Graph (G) of cities ➢ Create a Graph of N cities using Adjacency Matrix. ➢ Print all the nodes reachable from a given starting node in a diagraph using DFS/BFS method.
8	Design and develop a program in C that uses Hash Function H: K->L as H(K)=K Mod m (reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.
	PART-B
	A team of two students developed a prototype using the C/C++ language to demonstrate the use of data structures in real-time applications. For example, they used trees to index search results, graphs to navigate places, graphs for recommendations and match-making, queues for message passing, spell and grammar checkers, and matrices to generate survey insights. Their innovative applications of data structures attracted high marks. (Ref: https://www.geeksforgeeks.org/realtime-application-of-data-structures/).

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

III. COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Apply various linear and non-linear data structures.
CO2	Demonstrate the working nature of different types of data structures and their applications.
CO3	Analyze appropriate searching and sorting algorithms for the given scenario.
CO4	Analyze the appropriate data structure for solving real world problems.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	3											2		
CO2	2	1	2	1										2		
CO3	2	1	2	1										2		
CO4	2	1	2	1										2		

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 4

Continuous Internal Evaluation (CIE): Refer Annexure-1section 4

Semester End Examination (SEE): Refer Annexure-1 section 4

VI. Learning Resources

VII(a): Textbooks: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher

1	An Introduction to Data Structures with Applications	Jean-Paul Tremblay & Paul G. Sorenson	2nd edition , 1st July 2017	Tata McGraw Hill
2	Data Structures using C & C++	Aaron M. Tanenbaum	2nd edition , 2005	PHI Learning
3	Data and File Structures using C	Reema Thareja	2nd edition ,2014	Oxford University Press
VII(b): Reference Books: (Insert or delete rows as per requirement)				
1	Handbook of Data Structures and Applications,	Dinesh P Mehta, and SartajSahni	2nd edition ,28 October 2004	Chapman and Hall/CRC
VII(c): Web links and Video Lectures (e-Resources):				
• https://www.geeksforgeeks.org/realtime-application-of-data-structures				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
case studies, mini projects, self-study activities, group discussions, etc				

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Recognized by UGC, New Delhi with 2(f) & 12 (B)
(Department of Artificial Intelligence and Machine Learning)

Semester:	III	**Course Type:**	ETC		
Course Title: Object Oriented Programming with Java					
Course Code:	**23AIE311**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

Pre-requisite: Basic understanding of programming concepts and proficiency in any programming language

I. Course Objectives:

- To Acquire proficiency in fundamental constructs of the Java programming language.
- To Comprehend and apply the principles of Object-Oriented Programming (OOP) in Java.
- To Acquire expertise in advanced Java concepts including packages, multithreaded programming, and exception handling.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Overview of Java: Object-Oriented Programming (Paradigms, Abstraction, Three OOP Principles), Code Blocks, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, Java Keywords). Data Types, Variables, Arrays: Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Type Conversion and Casting, Automatic Type Promotion, Arrays, Type Inference with Local Variables.
Operators: Arithmetic, Relational, Boolean Logical, Assignment, Operator Precedence, Parentheses Usage.
Control Statements: Selection (if, switch), Iteration (while, do-while, for, For-Each Loop, Nested Loops), Jump Statements (break, continue, return).
Textbook: 1 Chapter: 2, 3, 4 5

RBT Levels: L1, L2

Module-2	8 Hrs

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, This Keyword, Garbage Collection. **Methods and Classes:** Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, introducing final, Introducing Nested and Inner Classes.
Textbook: 1 Chapter: 6,7

RBT Levels: L1, L2

Module-3	8 Hrs

Inheritance: Inheritance Basics, using super, creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.
Textbook: 1 Chapter:8, 9

RBT Levels: L1, L2,L3

Module-4	8 Hrs

Packages: Packages, Packages and Member Access, Importing Packages. **Exceptions:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.
Textbook: 1 Chapter:9,10

RBT Levels: L1, L2, L3

Module-5	8 Hrs

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Enumerations, Type Wrappers and Autoboxing:** Enumerations (Enumeration Fundamentals, The values () and valueOf () Methods),

Textbook: 1 Chapter:11,12

RBT Levels: L1, L2, L3

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real world problems.
CO4	Apply the concept of packages and exception handling in solving complex problem
CO5	Apply concepts of multithreading, autoboxing and enumerations in program development

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2												1			1
CO2		3												1	1	
CO3		3														

CO4			2	2	2								1			
CO5	1													1	1	1

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Java: The Complete Reference	Herbert Schildt	12th Edition, November 2021	McGraw-Hill, ISBN: 9781260463422

VII(b): Reference Books:

1	Programming with Java	E Balagurusamy	6th Edition Mar-2019	McGraw Hill Education, ISBN: 9789353162337.
2	Thinking in Java	Bruce Eckel	Fourth Edition, 2006	Prentice Hall

VII(c): Web links and Video Lectures (e-Resources):

- Java Tutorial: https://www.geeksforgeeks.org/java/
- Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
- Java Tutorial: https://www.w3schools.com/java/
- Java Tutorial: https://www.javatpoint.com/java-tutorial

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

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(Department of Artificial Intelligence and Machine Learning)

Semester:	III	**Course Type:**	ETC		
Course Title: Python for Data Science					
Course Code:	**23AIE312**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

Pre-requisite: Basic understanding of programming concepts and proficiency in any programming language

I. Course Objectives:

- To Understanding Python constructs and their application in program development.
- To Analysing various conditional statements and their practical usage in programming.
- To Learning and applying basic data structures in Python.
- To Demonstrating array manipulations through file data processing.
- To Grasping the utilization of diverse data types within a data analytics framework.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Introduction to python: Python Language Essentials: Core components of the Python language. Python Block Structure: Understanding the structure of Python code blocks. Variables and Assignment Statements: Concepts related to variables and assignment statements in Python. Data Types in Python: Exploring various data types

available in Python. Operations in Python: Overview of different operations supported by Python. Input/Output in Python: Utilizing simple input and output operations, including print statements. Formatting Print Statements: Techniques for formatting output using print statements in Python.

Text Book 1: Chapter 3 (3.2, 3.3, 3.4, 3.6, 3.7, 3.9 and 3.10)

RBT Levels: L1, L2

Module-2	8 Hrs

Decision structure: Forming Conditions: Creating conditional expressions to control program flow. If Statement: Understanding the basic if statement for conditional execution. If-Else and Nested If-Else: Exploring conditional branching with if-else statements, and nested if-else constructs for multiple conditions. Looping Statements: Introduction to Looping: Understanding the concept and necessity of loops in programming. Python Built-in Functions for Looping: Exploring built-in functions such as range() and enumerate() for efficient looping. Loop Statements: Implementing loop statements like for and while loops for repetitive tasks. Jump Statements: Understanding jump statements like break, continue, and pass for altering loop behaviour.

Text Book 1: Chapter 4 (4.2 to 4.6) , Chapter 5 (5.1 to 5.4)

RBT Levels: L1, L2

Module-3	8 Hrs

Lists: Introduction to Lists: Understanding list concepts and structure in Python. Operations on Lists: Exploring list operations like appending, removing, and accessing elements. **Tuple:** Introduction to Tuples: Understanding tuple basics and their immutability. Operations on Tuples: Exploring tuple operations such as concatenation and repetition. **Set:** Introduction to Sets: Understanding set data structure and creation methods. Operations in Sets: Exploring set operations like union, intersection, and difference.

Dictionary: Understanding dictionaries as key-value pairs. Operations on Dictionaries: Exploring dictionary operations like adding, updating, and deleting elements. Nested Dictionaries: Understanding and working with nested dictionaries. **Looping:** Looping Over Dictionaries: Iterating over dictionary elements using for loops. Practical Applications: Understanding how to use loops for dictionary manipulation and data processing.

Text Book 1: Chapter 7 (7.2 to 7.3), Chapter 8 (8.1 to 8.4) and Chapter 9(9.1 to 9.3, 9.7 to 9.12)

RBT Levels:L1,L2,L3

Module-4	8 Hrs

The NumPy: Ndarray: Understanding fundamental data structure. Basic Operations: Exploring mathematical and logical operations. Indexing, Slicing, and Iterating: Techniques for element manipulation. Conditions and Boolean Arrays: Utilizing Boolean arrays for filtering. Array Manipulation: Reshaping, resizing, and concatenating arrays. General Concepts: Overview of broadcasting and universal functions. Reading/Writing Array Data: Techniques for file operations. **Pandas:** Data Structures: Overview of Series and DataFrame. Functionalities on Indexes: Exploring hierarchical indexing. Operations Between Data Structures: Merging, joining, and concatenating. Function Application and Mapping: Applying functions for data transformation

Text Book 2: Chapter 3 and Chapter 4.

RBT Levels: L1, L2, L3

Module-5	8 Hrs

The pandas: Introduction to Pandas I/O tools. Reading CSV and Textual Files. Reading/Writing HTML Files. Reading Data from XML Files. Reading Data from Excel Files. Reading JSON Data. Pickle Serialization. **Pandas Data Manipulation:** Data Preparation: Techniques for cleaning and preprocessing. Concatenating Data: Combining datasets. Data Transformation: Sorting, filtering, and replacing values.

Text Book 2: Chapter 5 and Chapter 6

RBT Levels: L1, L2, L3

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain the Python programming constructs comprehensively.
CO2	Apply looping and conditional constructs proficiently in program development.
CO3	Apply data structures effectively to solve real-world problems.
CO4	Implement NumPy constructs proficiently for matrix manipulations.

CO5	Apply Panda constructs adeptly for data analytics purposes.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2											2	1	1	1
CO2	3	3											1	1	1	1
CO3	3	3											1	1	1	1
CO4	3		3										1	2	1	1
CO5	3			3									1	1	2	1

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Python Programming,	S. Sridhar, J. Indumathi, V.M. Hariharan	1st edition 2023.	Pearson publishers
2	Python Data Analytics	Fabio Nelli	1st Edition, 2015.	Apress, Publishing,

VII(b): Reference Books:

1	Intro to Python for Computer Science and Data science	Paul Deitel and Harvey deitel	1st edition 2020.	Pearson Publisher

VII(c): Web links and Video Lectures (e-Resources):

- Nptel: Introduction to Python for Data Science https://www.youtube.com/watch?v=tA42nHmmEKw&list=PLh2mXjKcTPSACrQxPM2_1Ojus5HX88ht7

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Assignments, Quizzes and Seminar

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(Department of Artificial Intelligence and Machine Learning)

Semester:	III	**Course Type:**	ETC		
Course Title: Introduction to Big Data Analytics					
Course Code:	**23AIE313**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

Pre-requisite: Basic understanding of programming concepts and proficiency in any programming language

I. Course Objectives:

- Understand fundamentals and applications of Big Data analytics
- Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
- Employ MapReduce programming model to process the big data
- Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT	
Theory	
Module-1	8 Hrs

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.
Textbook 1: Chapter 1: 1.2 -1.7

RBT Levels: L1, L2

Module-2	8 Hrs

Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop **Distributed File System Basics (T2):** HDFS Design Features, Components, HDFS User Commands. **Essential Hadoop Tools (T2):** Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.
Textbook 1: Chapter 2 :2.1-2.6 Textbook 2: Chapter 3, Chapter 7 (except walk throughs)

RBT Levels: L1, L2

Module-3	8 Hrs

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.
Textbook 1: Chapter 3: 3.1-3.7

RBT Levels: L1, L2

Module-4	8 Hrs

Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.
Textbook 1: Chapter 4: 4.1-4.6

RBT Levels: L1, L2

Module-5	8 Hrs

Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.
Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics
Textbook 1: Chapter 6: 6.1 to 6.5 Textbook 1: Chapter 9: 9.1 to 9.5

RBT Levels: L1, L2, L3

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain fundamentals and applications of Big Data analytics
CO2	Analyze Hadoop framework, Hadoop Distributed File system and essential Hadoop tools.
CO3	Apply the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3				1							1	1			
CO2	2	1	2		1							1		2		
CO3		2	3	1	1										1	
CO4	2	1	3		1									1		1
CO5	1	2	3		1							2			1	

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Big Data Analytics Introduction to Hadoop, Spark, and Machine Learning	Raj Kamal and Preeti Saxena,	2018	McGraw Hill Education, ISBN: 9789353164966
2	Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem	Douglas Eadline,	1st Edition, 2016.	Pearson Education, ISBN13: 978-9332570351

VII(b): Reference Books:

1	Hadoop: The Definitive Guide	Tom White	4th Edition, 2015	O"Reilly Media, ISBN-13: 978-9352130672
2	Professional Hadoop Solutions	Boris Lublinsky, Kevin T Smith, Alexey Yakubovich	1st Edition, 2014	Wrox Press, ISBN-13: 978-8126551071
3	Hadoop Operations: A Guide for Developers and Administrators	Eric Sammer	1st Edition, 2012	O'Reilly Media
4	Big Data Analytics: A Hands-On Approach	ArshdeepBahga, Vijay Madisetti	1st Edition, 2018	VPT Publications,

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=n_Krer6YWY4
- https://onlinecourses.nptel.ac.in/noc20_cs92/preview
- https://www.digimat.in/nptel/courses/video/106104189/L01.html
- https://web2.qatar.cmu.edu/~mhhammou/15440-f19/recitations/Project4_Handout.pdf

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

(Department of Artificial Intelligence and Machine Learning)

Semester:	III	**Course Type:**	ETC		
Course Title: Introduction To Cyber Security					
Course Code:	**23AIE314**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03
Pre-requisite:					

I. Course Objectives:

- To familiarize cybercrime terminologies and ACTs
- Understanding cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
- Understand the motive and causes for cybercrime, cybercriminals, and investigators
- Understanding criminal case and evidence, detection standing criminal case and evidence

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes,
Cybercrime: The Legal Perspectives,
Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000.
Textbook1:Ch1 (1.1 to 1.8).

RBT Levels: L1, L2

Module-2	8 Hrs

Cyber offenses: How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking,
Cybercafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector
Textbook1: Ch2 (2.1 to 2.7).

RBT Levels: L1, L2

Module-3	8 Hrs

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks.
Textbook1: Ch4 (4.1 to 4.9, 4.12).

RBT Levels: L1, L2

Module-4	8 Hrs

Understanding the people on the scene: Introduction, understanding cyber criminals, understanding cyber victims, understanding cyber investigators.
The Computer Investigation process: investigating computer crime.
Understanding Cybercrime Prevention: Understanding Network Security Concepts, Understanding Basic Cryptography Concepts, Making the Most of Hardware and Software Security
Textbook 2: Ch3, Ch 4, Ch 7

RBT Levels: L1, L2

Module-5	8 Hrs

Cybercrime Detection Techniques: Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems, Understanding E-Mail Headers Tracing a Domain Name or IP Address.
Collecting and preserving digital Evidence: Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence, documenting evidence.
Textbook 2:Ch 9, Ch 10.

RBT Levels: L1, L2

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Describe the cybercrime terminologies
CO2	Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
CO3	Analyze the motive and causes for cybercrime, cybercriminals, and investigators
CO4	Apply the methods for understanding criminal case and evidence, detection standing criminal case and evidence.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3				1							1	1	1	2	1
CO2	1	1	3	3	1								1	1		
CO3	1	2	3	2	1								1	1		
CO4	1	1	3	1	1								1			1

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	SunitBelapure and Nina Godbole,	2013	Wiley India Pvt Ltd, ISBN: 978-81- 265-21791
2	Scene of the cybercrime	Debra Little John Shinder and Michael Cross	2nd edition, 2008	Syngress publishing Inc, Elsevier Inc

VII(b): Reference Books:

1	Software Forensics	Robert M Slade,	2005	Tata McGraw Hill, New Delhi
2	Cybercrime	Bernadette H Schell, Clemens Martin	2004	ABC – CLIO Inc, California,
3	Computer Forensics and Investigations	Nelson Phillips and EnfingerSteuart,	2009	Cengage Learning, New Delhi
4	Incident Response and Computer Forensics	Kevin Mandia, Chris Prosise, Matt Pepe	2006	Tata McGraw -Hill, New Delhi

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=czDzUP1HclQ
- https://www.youtube.com/watch?v=qS4ViqnjkC8
- https://www.trendmicro.com/en_nz/ciso/21/h/cybercrime-today-and-the-future.html

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

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Sri Adichunchanagiri Shikshana Trust (R)
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Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	AEC		
Course Title: Data Visualisation and Analysis With Power BI					
Course Code:	**23AIAE31**			**Credits:**	01
Teaching Hours/Week (L: T: P: O) {O – Other pedagogies, mention @}			1:0:0:3	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	2.00 Hrs

Pre prerequisite: Basic understanding of data analysis concepts and familiarity with spreadsheet software like Excel. Additionally, knowledge of SQL for data querying and manipulation would be beneficial for advanced data analysis tasks in POWER BI.

I. Course Objectives:

- To gain a foundational understanding of Power BI, including Power BI Desktop and the Power BI website.
- To create various data visualizations, including stacked and clustered bar charts, waterfall charts, scatter plots, filled maps, and 3D maps.
- To prepare and transform data using Power Query for acquisition, grouping, binning, merging, joining, and transformation.
- To design and build interactive reports and dashboards, utilizing bookmarks, buttons, and KPIs for enhanced user interactivity.
- To perform advanced data analysis with DAX, creating measures, calculated columns, and using functions like SUMX, IF, FILTER, DatesInPeriod, DatesBetween, and WeekToDate.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

III. COURSE CONTENT

Module-1: Power BI Essentials	8 Hrs

Utilize POWER BI Desktop and its web counterpart, acquiring data from various sources including CSV files and folders. Master data transformation with Power Query, create visualizations, and distinguish between dashboards and reports for effective data presentation.

Textbook1:

RBT Levels: L1, L2, L3, L4

Module-2: Visualization in POWERBI	8 Hrs

Advanced visualization techniques in POWER BI, including various chart types, map visualizations, and interactive features like slicers, bookmarks, and buttons. Additionally, explore data grouping, binning, and Key Performance Indicators (KPIs) for effective data analysis and presentation.

Textbook1:

RBT Levels: L1,L2,L3, L4

Module-3: Basic Data Transformation in Power BI	8 Hrs

Power Query basics, data preparation, and importing data from Excel and Azure SQL Database. Understand the difference between reference vs duplicate and append vs merge in POWER BI for effective data transformation.

Textbook1:

RBT Levels: L1, L2, L3,L4

Module-4: Advanced Data Transformation in Power BI	8 Hrs

Advanced data manipulation techniques in POWER BI, including merge join types, pivot operations, grouping, exception reporting, flawless date conversion, and numeric division. These skills enhance ability to handle diverse data scenarios efficiently.

Textbook1:

RBT Levels: L1, L2, L3,L4

Module-5: Power BI Modeling And DAX	8 Hrs

Advanced data modelling and calculation techniques in POWER BI, including sorting, data preparation, relationship management, and using measures versus calculated columns. Explore functions like SUM vs SUMX, IF and FILTER, and address DAX time zone issues, enhancing data analysis skills.

Textbook 1:

RBT Levels: L1, L2, L3,L4

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Apply Power BI Desktop and its web counterpart to acquire, prepare, and transform data from various sources, including CSV files and Azure SQL Database, using Power Query.
CO2	Apply advanced visualization techniques, including various chart types, map visualizations, and interactive features like slicers, bookmarks, and buttons, for effective data presentation.
CO3	Implement data modeling techniques, including designing star schemas, managing relationships, and differentiating between measures and calculated columns.
CO4	Perform advanced data analysis and calculations with DAX, using functions like SUM vs SUMX, IF, FILTER, and handling DAX time zone issues.
CO5	Develop an interactive reports and dashboards, publish reports, and pin them to dashboards in the PowerBI.com service, utilizing KPIs for performance tracking.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3											1			
CO2			3	3										2		
CO3		2	2												1	1
CO4	3				3											
CO5			2		2				2					1		

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 5

Continuous Internal Evaluation (CIE): Refer Annexure-1section 5

Semester End Examination (SEE): Refer Annexure-1 section 5

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Power BI Cookbook: Creating Business Intelligence Solutions of Analytical Data Models, Reports, and Dashboards	Brett Powell	Second edition 2018	Packt Publishing
2	Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence	Brett Powell	Third Edition 2020	Packt Publishing
3	Power BI 10-Day Pass: A Practical Guide to Building Enterprise Data Models	Paul Turley	First Edition 2019	Independently published

VII(b): Reference Books:

1	M is for (Data) Monkey: A Guide to the M Language in Excel Power Query	Ken Puls and Miguel Escobar	First Edition 2015	Holy Macro! Books
2	Analyzing Data with Power BI and Power Pivot for Excel	Alberto Ferrari and Marco Russo	Second Edition 2017	Microsoft Press

VII(c): Web links and Video Lectures (e-Resources):

- [Microsoft Power BI Official Website] (https://powerbi.microsoft.com/)
- [Power BI Tips] (https://powerbi.tips/)
- [Guy in a Cube] (https://guyinacube.com/)
- [Power BI Blog] (https://powerbi.microsoft.com/en-us/blog/)
- [Enterprise DNA] (https://www.youtube.com/channel/UCiNm8KMJWggC4iRrxtnkovA)

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar, Mini projects

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
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BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
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Department of Artificial Intelligence and Machine Learning

Semester:	III	**Course Type:**	NCMC		
Course Title: Skilful Futures: Empowering Aptitude and Soft skills					
Course Code:	**23PDSN03**			**Credits:**	PP/NP
Teaching Hours/Week (L: T: P: O) {O – Other pedagogies, mention @}			0:0:0:2	**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	NA	**Total Marks:**	50
SEE Type:	Theory/practical/other assessment			**Exam Hours:**	NA
Pre prerequisite:					

I. Course Objectives:

- To strengthen logical and analytical thinking skills required to solve quantitative problems.
- To discuss the importance of ethical considerations in leadership and negotiation, emphasizing integrity, fairness, and accountability in decision-making and interactions.
- To apply problem-solving strategies to real-world situations.
- To crafting Effective Openings and Closings.
- To develop a systematic approach to creative problem solving

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

III. COURSE CONTENT

Module-1: Quantitative Aptitude-1	6 Hrs
Problems on Permutation and Combination. Problems on Surds and Indices	
Module-2: Visualiz Leadership and Negotiation skills	4 Hrs
Leader skills, Persuasion Skills, Negotiation Skills and Conflict Resolving Skills	
Module-3: Quantitative Aptitude – 02	6 Hrs
Problems on Percentage, Problems on Profit and Loss , Problems on cubes and Dices	

Module-4: Letter and Writing Skills	4 Hrs
Writing Skills, Formal, Informal Letters, Sample Letters, Business Professional writings and Adaptability in writing style	
Module-5: Logical Reasoning	4 Hrs
Syllogism Concepts and Logical Deduction	

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Solve complex problems related to Arithmetic, algebra, geometry, Statistics Permutation and Combination, demonstrating a strong understanding of the concepts.
CO2	Apply Surds and Indices concepts proficiently to solve mathematical problems with precision.
CO3	Develop leadership skills, including effective communication, persuasion, negotiation, and conflict resolution techniques.
CO4	Demonstrate proficiency in solving Percentage, Profit and Loss, and cubes and Dices problems, showcasing quantitative aptitude.
CO5	Enhance writing skills by effectively composing formal and informal letters, business professional writings, and adapting writing styles to different contexts.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2						2				1	1		2	1
CO2								2	2			2		2		
CO3	2	2						2				2			1	
CO4										2		2				2
CO5	2	2										1	1	1		1

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 8

Continuous Internal Evaluation (CIE): Refer Annexure-1section 8

Semester End Examination (SEE): Refer Annexure-1 section 8

VI. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1				

VII(b): Reference Books:

1	Quantitative Aptitude for Competitive examination	R S Agarwal	2017	S Chand
2	Are we leading?	Kaushik Mahaputhra	2020	Notion press
4	A modern approach to logical reasoning	R S Agarwal	2019	S Chand

VII(c): Web links and Video Lectures (e-Resources):

- https://swayam.gov.in/explorer
- https://nptel.ac.in/courses

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar, group discussions etc.

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
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Department of Mathematics

Semester:	IV	**Course Type:**	BSC		
Course Title: Probability Distributions and Statistical Methods					
Course Code:	**23AIT401**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			2:2:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

This course will enable students to :

- To facilitate the students with a concrete foundation of probability distributions.
- Understand the concepts of sampling distributions.
- Learn the concepts of curve fitting and statistical techniques.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, innovative teaching methods shall be adopted.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Grading assignments and quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1: Curve fitting and Statistical Techniques	8Hrs

Curve fitting by method of least squares: $y = ax+b$, $y = ax^2 +bx+c$ and $y= ab^x$, Correlation–Karl Pearson's coefficient of correlation, Regression analysis – lines of regression (without proof)-problems, Rank correlation.

Applications of multiple regression in performance tuning and optimization in software engineering.

*** Application problems to be excluded for SEE**

Textbook1: Chapter 24(24.4 to 24.6, 24.8) ,Chapter 25(25.12 to 25.14, 25.16).

Self Learning: Angle between two regression lines, problems, Fitting of the curve $y= ax^b$

RBT Levels:L1, L2 and L3

Module-2: Probability Distributions	8Hrs

Review of basic probability theory. Random Variables (Discrete and Continuous). Probability mass and density functions. Mathematical expectation, Mean and varience. Discrete probability distributions: Binomial, Poisson and Normal distributions (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.
Applications to analyze the performance of the algorithms.
*** Application problems to be excluded for SEE.**

Textbook1: Chapter 26.7 to 26.10, 26.14 to 26.17.

Self Learning: Geometric distribution and Exponential distribution.

RBT Levels:L1, L2 and L3

Module-3: Two dimensional Random variables and Stochastic process	8Hrs

Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.
Stochastic process:
Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.
Applications to rank web pages based on their importance.
*** Application problems to be excluded for SEE).**

Textbook2: Chapter 31(31.1 ,31.2).

Self Learning: Conditional density function.

RBT Levels: L1, L2 and L3

Module-4: Sampling distributions	8Hrs

Introduction to Sampling distributions, Standard error, Type-I and Type-II errors. Test of hypothesis for means. Confidence limits for means, Student's t-distribution, Chi-square distribution as a test of goodness of fit. F-distribution.
Textbook1: Chapter 27 (27.1 to 27.8, 27.10 to 27.12, 27.14, 27.15, 27.17, 27.18 and 27.19).
Self Learning: Point estimation and interval estimation.

RBT Levels: L1, L2 and L3

Module-5: Design of Experiments & ANOVA	8Hrs

Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design.
Textbook3: Chapter 12(12.4, 12.5 ,12.6).
Self Learning: Analysis of Co-Variance

RBT Levels: L1, L2 and L3

IV.COURSE OUTCOMES

The student will be able to:

CO1	Illustrate the basic concepts of statistics, probability and sampling theory.
CO2	Apply the knowledge of statistical techniques and probability distributions of Random variables .
CO3	Analyse the concepts of statistics, sampling techniques and probability distributions for models arising in the engineering field.
CO4	Interpret the strength and limitations of statistical data, probability distributions and sampling theory.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/ PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	3	2	1									1	1	2	
CO2	3	2	1									1	1	3	
CO3	3	2	1									1	1	3	
CO4	3	2	1									1	1	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer CIE and SEE guidelines based on course type for autonomous scheme 2023

Continuous Internal Evaluation (CIE): Refer annexure section 1

Semester End Examination (SEE): Refer annexure section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Name of the publisher
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers
2	Higher Engineering Mathematics	B.V.Ramana	Tata Mc Graw-Hill
3	Probability & Statistics for Engineers & Scientists	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye	Pearson Education

VII(b): Reference Books:

1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Ed., 2016
2	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw – Hill Book Co.,	6th Ed., 2017
3	Probability & Statistics for Engineers & Scientists	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye	Pearson Education	9th Ed., 2023.
4	Linear Algebra and its Applications	David C Lay	Pearson Publishers	4th Ed., 2018.

VII(c): Web links and Video Lectures (e-Resources):

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central-central.com/subject/math(MOOCs)
3. http://academiccarth.org/
4. VTU EDUSAT programme-20

VIII: Activity Based Learning

Assignments / Quiz / Presentation.

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	PCC		
Course Title: Analysis & Design of Algorithms					
Course Code:	**23AIT402**			**Credits:**	**03**
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	**40**
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	**100**
SEE Type:	Theory			**Exam Hours:**	**03**

Pre-requisites: Fundamental knowledge in the C/C++ programming language

I. Course Objectives:

- To Understand how to analyze algorithms and evaluate their performance.
- To State algorithm efficiencies using asymptotic notations.
- To Apply various algorithm design techniques, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
- To Choose appropriate data structures and algorithm design methods for specific applications.
- To Familiarize yourself with the P and NP complexity classes.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs
Introduction-Perspectives: In the field of computer science and algorithmic problem-solving, various business domains and applications benefit from algorithmic techniques. **Business domain:** Banking, Finance services, IT, Manufacturing, e-Commerce, Online services and marketing, Logistics and Supply Chain Management, Telecommunication. **Applications:** Communication & Networking, Search engines, Machine learning, Database management, Software tools development, Data organization, GPS navigation systems **Introduction to Algorithms:** Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Brute force design technique:** Selection Sort and Bubble Sort. **Textbook 1:** Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2) **Textbook 2:** Chapter 1(section 1.1,1.2,1.3)	
RBT Levels: L1, L2, L3	
Module-2	8 Hrs
Divide and Conquer: Merge sort, Quicksort, Multiplication of Long Integers, Strassen's Matrix Multiplication. Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Application of DFS and BFS. **Textbook 2:** Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6) **Textbook 1:** Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.2,5.3)	
RBT Levels: L1, L2, L3	
Module-3	8 Hrs
Transform and Conquer: Presorting, Heapsort, Problem reduction. Space and Time Tradeoffs: Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm. **Textbook 2**: Chapter 4(Sections 4.1,4.3,4.5) **Textbook 1**: Chapter 9(Section 9.1,9.2,9.3,9.4), Chapter 6(section 6.4)	
RBT Levels:L1,L2,L3	
Module-4	8 Hrs
Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, Knapsack Problem and Memory Functions. Greedy Technique: Prim's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes, Fractional Knapsack Problem. **Textbook 2**: Chapter 5 (Sections 5.1,5.2,5.4,5.9) **Textbook 1:** Chapter 8(Sections 8.2,8.4), Chapter 7 (Sections 7.1,7.2)	
RBT Levels: L1, L2, L3	
Module-5	8 Hrs
Backtracking: N-Queen's Problem, Sum of Subset Problem. **Branch-and-Bound:** Travelling Salesperson Problem, Assignment Problem **Decision Trees:** Decision Trees for Sorting **NP and NP-Complete Problems:** Basic Concepts, Non- Deterministic Algorithms, P, NP, NP Complete, and NP-Hard classes	
RBT Levels: L1,L2,L3	

COURSE OUTCOMES

CO1	Apply computing knowledge and mathematical principles to design algorithms.
CO2	Apply divide and conquer and decrease and conquer techniques to solve problems and analyze their effectiveness.
CO3	Demonstrate algorithmic principles and theory to model and evaluate computer-based solutions, considering design trade-offs.
CO4	Apply dynamic programming techniques to solve problems, enhancing algorithm time efficiency even if it requires sacrificing space
CO5	Analyze backtracking and branch-and-bound methods, and describe the concepts of P, NP, and NP-Complete problems.

CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2	1	2					1		2	2	2		
CO2	1	2	3	1	1					1		2	1	2		
CO3	2	2	3	1	2					1		2	1	1		
CO4	2	2	3	1	2					1		2	1	2		
CO5	1	2	3	1	1					1		2	2	1		

Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

Learning Resources

Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd Edition, 2012	Pearson, ISBN 13: 978-0-13-231681-1
2	Computer Algorithms/C++,	Ellis Horowitz, SatrajSahni and Rajasekaran,	2nd Edition, 2014,	Universities Press
Reference Books:				
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	3rd Edition	PHI.
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.,	3rd Edition, 2010,	PHI, ISBN:9780262033848.
3	Design and Analysis of Algorithms	S. Sridhar		Oxford Higher Education

VII(c): Web links and Video Lectures (e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
- https://nptel.ac.in/courses/106/101/106101060/
- http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html
- http://cse01-iiith.vlabs.ac.in/
- http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

1. Assignments, Quizzes and Seminar
2. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,
3. Demonstration of solution to a problem through programming.

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	IPCC		
Course Title: Introduction to Artificial Intelligence					
Course Code:	**23AII403**			**Credits:**	**04**
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:2:0	**Total Hours:**	**40+8-10 slots**
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	**100**
SEE Type:	Theory			**Exam Hours:**	**03**
Pre-requisites:					

I. Course Objectives:

- To impart artificial intelligence principles, techniques and its history
- To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
- To develop intelligent systems by assembling solutions to concrete computational problems

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Introduction- Evolution of AI, State of Art -Different Types of Artificial Intelligence- Applications of AI-Subfields of AI-Intelligent Agents- Structure of Intelligent Agents-Environments **Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4**
RBT Levels: L1, L2

Module-2	8 Hrs
Problem Solving based on Searching: Introduction to Problem Solving by searching Methods-State Space search, Uninformed Search Methods – Uniform Cost Search, Breadth First Search- Depth First Search-Depth-limited search, Iterative deepening depth-first, Informed Search Methods- Best First Search, A* Search **Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4, 3.5**	
RBT Levels: L1,L2, L3	

Module-3	8 Hrs
Local Search and Adversarial Search: Local Search algorithms – Hill-climbing search, Simulated annealing, Genetic Algorithm, Adversarial Search: Game Trees and Minimax Evaluation, Elementary two-players games: tic-tac-toe, Minimax with Alpha-Beta Pruning. **Text book 1: Chapter 4- 4.1, 4.2, 4.3, 4.4, 4.5, Chapter 5: 5.1, 5.2,5.3,5.4**	
RBT Levels: L1,L2, L3	

Module-4	8 Hrs
Logic and Reasoning: Introduction to Logic and Reasoning -Propositional Logic-First Order Logic-Inference in First Order Logic- Unification, Forward Chaining, Backward Chaining, Resolution. **Text book 1: Chapter 7- 7.1, 7.4, Chapter 8: 8.1, 8.2,8.3,8.4, Chapter 9: 9.2, 9.3, 9.4, 9.5**	
RBT Levels: L1,L2, L3	

Module-5	8 Hrs
Uncertain Knowledge and Reasoning: Quantifying Uncertainty- Bayes Rule -Bayesian Belief Network-Approximate Inference in Bayesian networks, **An Ethical Framework for a Good AI Society**: opportunities, Risks, principles and Recommendations. Establishing the rules for building trustworthy AI. **Design AI for Social Good: seven essential factors From What to How**: An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices. Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6, Text Book 2: Chapter 20 Textbook 3: Chapter 3, Chapter 4, Chapter 9, Chapter 10	
RBT Levels: L1,L2, L3	

III(b). PRACTICAL PART.

Sl. No.	RACTICAL COMPONENT **NOTE**: Programs need to be implemented in python
1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2	Implement and Demonstrate Best First Search Algorithm on Missionaries-Cannibals Problems using Python
3	Implement A* Search algorithm
4	Implement AO* Search algorithm
5	Solve 8-Queens Problem with suitable assumptions
6	Implementation of TSP using heuristic approach
7	Implementation of the problem-solving strategies: either using Forward Chaining or Backward Chaining
8	Implement resolution principle on FOPL related problems
9	Implement Tic-Tac-Toe game using Python
10	Build a bot which provides all the information related to text in search box
11	Implement any Game and demonstrate the Game playing strategies

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

COURSE OUTCOMES

CO1	Ability to assess various Artificial Intelligence (AI) methods and explain their foundational principles.
CO2	Applying fundamental AI principles to solve problems involving problem-solving, inference, perception, knowledge representation, and learning.
CO3	Demonstrate reasoning, uncertainty, and knowledge representation, essential for addressing real-world challenges.
CO4	Analyze the critical role of search algorithms in problem-solving.
CO5	Apply AI principles in practical situations.

CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3		1		2								1	1	1	1
CO2	2	1	3		2									1	2	2
CO3	3		2		2			2							2	
CO4	3			3	2			1						2		2
CO5	3		3		2			3								2

Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 2

Continuous Internal Evaluation (CIE): Refer Annexure-1section 2

Semester End Examination (SEE): Refer Annexure-1 section 2

Learning Resources

Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Artificial Intelligence	Stuart J. Russell and Peter Norvig	3rd Edition, 2015	Pearson
2	Artificial Intelligence	Elaine Rich, Kevin Knight	3rd Edition 2013	Tata McGraw Hill
3	Ethics, governance and Policies in Artificial Intelligence	Luciano Floridi, Springer,	1st Edition 2021, doi.orghttps /10.1007/978-3-030-81907-1, 2021.	Oxford Internet Institute, University of ixford, UK

Reference Books:

1	Artificial Intelligence Structure and strategies for complex	George F Lugar,	5th Edition, 2011	Pearson Education
2	Fundamentals of Artificial Intelligence	K. R. Chowdhary,	2020	Springer
3	Introduction to Machine Learning.	Alpaydin, E.	2nd Edition, 2010.	MIT Press.
4	Principles of Artificial Intelligence	Nils J. Nilsson,	1980	Elsevier
5	Artificial Intelligence	Saroj Kaushik	2014	Cengage learning
6	Ethics and AI: Navigating the Moral Landscape of Digital Age	Aaron Aboagye	-	-

VII(c): Web links and Video Lectures (e-Resources):

- https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
- https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
- https://nptel.ac.in/courses/106/105/106105077/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

1. Assignments, Quizzes and Seminar
2. Activity Based Learning /Practical Based learning
3. Group discussion on Real world examples
4. Project based learning
5. Simple Strategies on gaming, reasoning and uncertainty etc

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	IPCC		
Course Title: OPERATING SYSTEMS					
Course Code:	**23AII404**			**Credits:**	04
Teaching Hours/Week (L: T: P: O)			3:0:2:0	**Total Hours:**	40+8 -10 slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

Pre prerequisite: Computer Organisation, C language

I. Course Objectives:

- To Learn how operating systems manage hardware resources, schedule tasks, and provide user-friendly interfaces.
- To Explore efficient strategies for handling CPU, memory, storage, and input/output devices.
- To Demonstrate key APIs and commands for process control, memory allocation, and file system management.
- To Address security risks, including malware and unauthorized access, to maintain system stability and integrity.

II. Teaching-Learning Process:

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources□ LCD/Smart Boards □ Stud. Seminars

III COURSE CONTENT

III(a). Theory PART

Module-1:	**8 Hrs**

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.

Operating System Services: User Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot. **Textbook 1: Chapter - 1 (1.1-1.12), 2 (2.2-2.11)**
RBT Levels: L1, L2, L3

Module-2	**8 Hrs**
Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication **Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; Threading issues. **Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling: Multiple-processor scheduling, **Textbook 1: Chapter 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1-5.5)**	
RBT Levels: L1, L2, L3	

Module-3	**8 Hrs**
Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Textbook 1: Chapter - 6 (6.1-6.6), 7 (7.1 -7.7)**	
RBT Levels: L1, L2, L3	

Module-4	**8 Hrs**
Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)**	
RBT Levels: L1, L2, L3	

Module-5	**8 Hrs**
File System, Implementation of File System: File system: File concept: Access methods; Directory and Disk structure; File system mounting: File sharing; File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Comparison and Unix and windows. **Secondary Storage Structure, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; **Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix. **Textbook 1: Chapter - 10 (10.1-10.5),11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4)**	
RBT Levels: L1, L2, L3	

III(b). PRACTICAL PART.

Sl. No.	**Experiments**
	PART-A
1.	Execute the basic commands of Unix
2.	Develop a C program to implement the process system calls (fork(), exec(), wait(), create process, terminate process)
3.	Develop a C program that simulates process scheduling algorithms (FCFS and SJF for demonstration).
4.	Develop a C program to simulate producer-consumer problem using semaphores.
5.	Develop a C programs demonstrating inter-process communication (IPC) using Pipes and Shared Memory.
6.	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit b) Best fit c) First fit.
7.	Develop a C program to simulate Bankers Algorithm for Dead Lock Avoidance.
8.	Develop a C program to simulate page replacement algorithms: a) FIFO b) LRU
9.	Develop a C program to simulate SCAN disk scheduling algorithm.

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

COURSE OUTCOMES

CO1	Apply the fundamental components and roles of an operating system.
CO2	Apply suitable scheduling algorithms to optimize task execution on the CPU.
CO3	Analyze techniques for managing concurrent processes and preventing deadlocks.
CO4	Implement strategies for efficient memory allocation and utilization
CO5	Demonstrate strategies for organizing and accessing files and secondary storage.

II. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3				3						2		3			
CO2	3	2	2	2	3						2	3	3	2		
CO3	2	2	2	2	3						2	3	2	2		
CO4	3	2			3						2		3	1		
CO5	2				3						2		2			

III. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 2

Continuous Internal Evaluation (CIE): Refer Annexure-1section 2

Semester End Examination (SEE): Refer Annexure-1 section 2

IV. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Operating System Principles	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	8th edition, 2015	Wiley-India

VII(b): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Understanding Operating system	Ann McHoes Ida M Fylnn	6th edition	Cengage Learning
2.	Operating systems: A concept-based approach	D M Dhamdhere	3rd , 2013	McGraw
3.	Operating systems	William Stallings	6th	Pearson

VII(c): Web links and Video Lectures (e-Resources):

- https://youtu.be/vBURTt97EkA
- https://www.youtube.com/watch?v=783 KAB-tuE4&list=PLIemF3uozcAKTgsCj82 voMK3 TMROYE_f
- https://www.youtube.com/watch?v3TLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6m kO

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes, Seminar

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	PCCL		
Course Title: Analysis & Design of Algorithms Lab					
Course Code:	23AIL405			**Credits:**	1
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			0:0:2:0	**Total Hours:**	20.00
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Practical**			**Exam Hours:**	3.00

Pre-Prerequisite: Practical knowledge in the C/C++ programming language

I. Course Objectives:

- To learn the methods for analysing algorithms and evaluating their performance.
- To demonstrate the efficiency of algorithms using asymptotic notations.
- To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
- To learn the concepts of P and NP complexity classes.

II. Teaching-Learning Process (General Instructions):

Note: The following programs should be implemented in C/C++ language

PART-A

Sl. No.	List of Laboratory Experiments
1	**Practice Programs:** • Implementation and execution of simple programs to understand running time analysis of non-recursive algorithms • Finding maximum element in a given array. • Linear search, • Bubble sort, • Determine whether all the elements in a given array are distinct. • Given 2 NXN matrices, perform matrix multiplication using brute force approach. • Implementation and execution of simple programs to understand running time analysis of recursive algorithms • Find the Factorial of a given number. • Print Fibonacci series • Given a positive decimal integer n, find the number of binary digits in n's binary representation. • To solve tower of Hanoi problem. • Recursive linear search.
Lab Programs:(At-least one application from each of the following group)	
1	Apply divide and conquer strategy to solve sorting problem • Merge sort • Quicksort

2	Apply decrease and conquer strategy to solve graph problem • Breadth first search • Topological sorting using depth first search
4	Apply transform and conquer strategy • Heapsort • Checking element uniqueness after pre-sorting
5	Apply input enhancement strategy to solve string-matching problem • Horspool's algorithm • Boyer – Moore's algorithm
6	Apply dynamic programming strategy to solve optimization problem •Warshall - Floyd's Algorithms, • Knapsack problem solution using memory function.
7	Apply greedy strategy to solve graph problem • Dijkstra's algorithm • Prim's algorithm

PART-B

	A team of two students developed a prototype using the C/C++ language to demonstrate the use of Design and Analysis of Algorithm in real-time applications. For example, they used trees to index search results, graphs to navigate places, graphs for recommendations and match-making, queues for message passing, spell and grammar checkers, and matrices to generate survey insights. Their innovative applications of data structures attracted high marks.

Instructions for conduction of practical part:

- **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.
- **Experiential Learning**: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

III. COURSE OUTCOMES:

CO1	Develop programs to solve computational problems using suitable algorithm design strategy.
CO2	Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).
CO3	Apply suitable integrated development tools to develop programs.
CO4	Apply appropriate algorithm techniques to solve computational and complex problems.
CO5	Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences.

IV. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	2	1								2	2	2		
CO2	2	3	2	2								2	1	2		
CO3	2	2	3	2								2	1	1		
CO4	2	2	2	3								2	1	2		
CO5	2	2	2	3								2	2	1		

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 4

Continuous Internal Evaluation (CIE): Refer Annexure-1section 4

Semester End Examination (SEE): Refer Annexure-1 section 4

VI. Learning Resources

VII(a): Textbooks:(Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher

1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd Edition, 2012	Pearson, ISBN 13: 978-0-13-231681-1
2	Computer Algorithms/C++,	Ellis Horowitz, SatrajSahni and Rajasekaran,	2nd Edition, 2014,	Universities Press
Reference Books:				
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein	3rd Edition	PHI.
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.,	3rd Edition, 2010,	PHI, ISBN:9780262033848.
3	Design and Analysis of Algorithms	S. Sridhar		Oxford Higher Education

VII(c): Web links and Video Lectures (e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
- https://nptel.ac.in/courses/106/101/106101060/
- http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html
- http://cse01-iiith.vlabs.ac.in/
- http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

1. Assignments, Quizzes and Seminar
2. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,
3. Demonstration of solution to a problem through programming.

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(Department of Artificial Intelligence and Machine Learning)

Semester:	IV	**Course Type:**	ETC		
Course Title: Advanced Java & J2EE					
Course Code:	**23AIE421**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03
Pre-requisite:					

I. Course Objectives:

- Understanding the fundamental concepts of Enumerations and Annotations
- Apply the concepts of Generic classes in Java programs
- Demonstrate the fundamental concepts of String operations
- Design and develop web applications using Java servlets and JSP
- Apply database interaction through Java database Connectivity

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Enumerations, Autoboxing and Annotations: Enumerations, Enumeration fundamentals, the values() and valueOf() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers, Autoboxing, Autoboxing methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of warning

Annotations: Annotation basics, specifying retention policy, obtaining annotations at run time by use of reflection, Annotated element interface, using default values, Marker Annotations, Single member annotations, Built in annotations

Textbook 1: Chapter12

RBT Levels: L1, L2,L3

Module-2	8 Hrs

Generics: What are Generics, A Simple Generics Example, A Generic Class with Two Type Parameters, The General Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Bounded Wildcards, Creating a Generic Method, Generic Interfaces, Raw types and Legacy code, Generic Class Hierarchies, Erasure, Ambiguity errors, Some Generic Restrictions

Textbook 1: Chapter 14

RBT Levels: L1, L2,L3

Module-3	8 Hrs

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf (), Changing the case of characters within a String, String Buffer, String Builder

Textbook 1: Chapter 15

RBT Levels: L1, L2, L3

Module-4	8 Hrs

Background; The life cycle of a servlet: A simple servlet; the servlet API; The javax.servlet package Reading servlet parameter; the javax.servlet.http package; Handling HTTP Requests and Responses; using Cookies; Session Tracking,

Java Server Pages (JSP): JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects

Textbook 1: Chapter 31 Textbook 2: Chapter 11

RBT Levels: L1, L2, L3

Module-5	8 Hrs

The concept of JDBC: JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data Types; Exceptions.

Textbook 2: Chapter 6

RBT Levels: L1, L2, L3

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain the fundamental concepts of Enumerations and Annotations
CO2	Apply the concepts of Generic classes in Java programs
CO3	Demonstrate the concepts of String operations in Java
CO4	Develop web-based applications using Java servlets and JSP
CO5	Illustrate database interaction and transaction processing in Java

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2											1	1	2	2	1
CO2		2	2	2									1			1
CO3		2	2									1	1		2	2
CO4	3			2	2								1	1		1
CO5			2		1							1				2

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	JAVA the Complete Reference	Herbert Schildt	9th Edition	Tata McGraw-Hill
2	The Complete Reference J2EE,	Jim Keogh	7th Edition	Tata McGraw-Hill

VII(b): Reference Books:

1	Introduction to JAVA Programming	Y. Daniel Liang	7th Edition, 2007	Pearson Education

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106/105/106105191/ https://nptel.ac.in/courses/106/105/106105225/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

|| Jai Sri Gurudev ||
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(Department of Artificial Intelligence and Machine Learning)

Semester:	IV	**Course Type:**	ETC		
Course Title: Introduction to TensorFlow					
Course Code:	**23AIE422**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03
Pre-requisite:					

I. Course Objectives:

- To Understand the fundamentals of TensorFlow and its applications in artificial intelligence.
- To Dive deeper into TensorFlow concepts such as computation graphs, sessions, and fetches.
- To Learn how to work with text and sequence data.
- To Explore TensorFlow's high-level API, contrib.learn.
- To Learn about distributed computing in TensorFlow and how to export and serve models using TensorFlow Serving.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs
Introduction to TensorFlow and AI Systems: Going Deep, Using TensorFlow for AI Systems, Generating rich natural language descriptions for images, Text summarization, TensorFlow: What's in a Name? A High-Level Overview, Go with the Flow: Up and Running with TensorFlow, Installing TensorFlow, MNIST, Softmax Regression **Text book 1: Chapter1, Chapter 2**	
RBT Levels: L1, L2	
Module-2	8 Hrs
Understanding TensorFlow Basics: Computation Graphs, Graphs, Sessions, and Fetches, Flowing Tensors, Nodes Are Operations, Edges Are Tensor Objects, Setting attributes with source operations, Data Types, casting, Tensor Arrays and Shapes, Names, Variables, Placeholders, and Simple Optimization **Convolutional Neural Networks**: Introduction to CNNs, MNIST: Take II, CIFAR10 **Text book 1: Chapter3, Chapter-4**	
RBT Levels: L1, L2, L3	
Module-3	8 Hrs
Text Processing with TensorFlow: Text I: Working with Text and Sequences, and TensorBoard Visualization, The Importance of Sequence Data, Recurrent Neural Networks, RNN for Text Sequences. **Text II:** Word Vectors, Advanced RNN, and Embedding Visualization, Word Embeddings, Word2vec, Pretrained Embeddings, Advanced RNN **Text book 1: Chapter 5, Chapter 6**	
RBT Levels: L1, L2, L3	
Module-4	8 Hrs
TensorFlow Abstractions and Simplifications: contrib.learn, Linear Regression, DNN Classifier, Feature Column, Homemade CNN with contrib.learn, TFLearn **Queues, Threads, and Reading Data:** The Input Pipeline, TFRecords, Queues, Enqueuing and Dequeuing, Multithreading, Coordinator and Queue Runner, A Full Multithreaded Input Pipeline,tf.train.string_input_producer() and tf.TFRecordReader(),tf.train.start_queue_runners() and Wrapping Up **Text book 1: Chapter 7, Chapter 8**	
RBT Levels: L1, L2, L3	
Module-5	8 Hrs
Distributed TensorFlow: Distributed Computing, Where Does the Parallelization Take Place?, What Is the Goal of Parallelization?, TensorFlow Elements, Clusters and Servers, Replicating a Computational Graph Across Devices, Managed Sessions, Device Placement, Distributed Example, **Exporting and Serving Models with TensorFlow**: Saving and Exporting Our Model, Introduction to TensorFlow Serving **Text Book 1: Chapter -9, chapter-10**	
RBT Levels: L1, L2, L3	

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain TensorFlow basics for AI applications, including setting up, building simple models like softmax regression, and creating image descriptions.
CO2	Develop expertise with TensorFlow's computation graphs to construct and refine convolutional neural networks for image classification.
CO3	Apply skills in text processing with recurrent neural networks, using advanced techniques like word embeddings and TensorBoard for analysis
CO4	Apply TensorFlow to simplify complex model implementation and efficiently manage data with pipelines and threading.
CO5	Apply distributed computing in TensorFlow to improve model performance and scalability, and learn model exporting and serving for practical use.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2		3		2								1			
CO2		1	3		3									1		1
CO3				2	3										1	

CO4	2	1			2									1	1	1
CO5		1	3		2											

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Learning TensorFlow	Tom Hope, Yehezkel S. Resheff, and Itay Lieder	2017	O'Reilly Media, Inc. ISBN: 9781491978511

VII(b): Reference Books:

1	Hands-On Machine Learning with Scikit-Learn and TensorFlow	Aurélien Géron	2017	O'Reilly Media, Inc

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=LLux1SW--oM
- https://www.youtube.com/playlist?list=PL_Ig1a5kxu53IvHSkm9JWbA04lQ3H9eLC
- https://www.youtube.com/watch?v=q_IkJcPyNl0

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

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(Department of Artificial Intelligence and Machine Learning)

Semester:	IV	**Course Type:**	ETC		
Course Title: Business Intelligence					
Course Code:	**23AIE423**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03
Pre-requisite:					

I. Course Objectives:

- Explain the Decision Support systems and Business Intelligence framework.
- Illustrate the significance of computerized Decision Support, and understand the mathematical Modeling behind decision support.
- Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes. Explore knowledge management; explain its activities, approaches and its implementation.
- Describe the Expert systems, areas suitable for application of expert's system

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Decision Support and Business Intelligence: Opening Vignette, Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A framework for Business Intelligence (BI), A Work System View of Decision Support.
Text Book 1: Chapter 1

RBT Levels: L1, L2

Module-2	8 Hrs

Computerized Decision Support: Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported.
Modeling and Analysis: Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal
Text Book 1: Chapter 2

RBT Levels: L1, L2

Module-3	8 Hrs

Data Warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes.
Text Book 1: Chapter 5

RBT Levels: L1, L2

Module-4	8 Hrs

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation.
Text Book 1: Chapter 11

RBT Levels: L1, L2

Module-5	8 Hrs

Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and Critical Success Factors of Expert Systems.
Text Book 1: Chapter 12

RBT Levels: L1, L2

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework.
CO2	Describe the significance of Computerized Decision Support, apply the basics of mathematics to Understand the mathematical modeling behind decision support.
CO3	Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.
CO4	Analyze the importance of knowledge management and explain its activities, approaches and Its implementation
CO5	Describe the Expert systems and analyze its development, discuss areas suitable for application of experts system.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	1		3										1	1		1
CO2	2	1	2										1	2		1
CO3	2	1											1		1	1
CO4	2	3	3	1									1	2	2	
CO5	3	1	2										1		1	1

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Business Intelligence, A managerial Perspective on Analytics.	Sharda, R, Delen D, Turban E.	2014	Pearson.

VII(b): Reference Books:

1	Data Mining Techniques. For Marketing, Sales and Customer Relationship Management	Berry M.&Linoff G.	2004	Wiley Publishing Inc
2	Data Science for Business	Foster Provost and Tom Fawcett,	I2013	O'Reilly Media, Inc

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=3DTFmMNiGlg
- https://www.youtube.com/watch?v=Hg8zBJ1DhLQ

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)
(Department of Artificial Intelligence and Machine Learning)

Semester:	IV	**Course Type:**	ETC		
Course Title: Blockchain Technology					
Course Code:	**23AIE424**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03
Pre-requisite:					

I. Course Objectives:

- Explain the fundamentals of distributed computing and blockchain
- Discuss the concepts in bitcoin
- Demonstrate Ethereum platform

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

COURSE CONTENT

Theory

Module-1	8 Hrs

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.
Textbook 1: Chapter 1, 2

RBT Levels: L1, L2

Module-2	8 Hrs

Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency,
How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work, Putting it all together,
Textbook 2: Chapter 1, 2

RBT Levels: L1, L2

Module-3	8 Hrs

Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.
How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets
Textbook2: Chapter 3,4

RBT Levels: L1, L2

Module-4	8 Hrs

Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies,
Bitcoin and Anonymity: Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash,
Textbook2: Chapter 5,6

RBT Levels: L1, L2

Module-5	8 Hrs

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts.
Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.
Textbook 1: Chapter 10

RBT Levels: L1, L2

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Describe the concepts of Distributed computing and its role in Blockchain
CO2	Describe the concepts of Cryptography and its role in Blockchain
CO3	Explain the benefits, drawbacks and applications of Blockchain
CO4	Implement the technologies associated with Bitcoin.
CO5	Developing blockchain applications using the Ethereum platform.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	1	1									1	2	1		1
CO2	3	1	1									1	2		1	2
CO3	2	3	2									1	1	1	1	2
CO4	1	1	3										1		1	
CO5	2	1	3									1	1	1	1	2

IV. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 1

Continuous Internal Evaluation (CIE): Refer Annexure-1section 1

Semester End Examination (SEE): Refer Annexure-1 section 1

V. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained	Imran Bashir	Second Edition, 2017	Packt Publishing Ltd ISBN 978-1-78712-544-5
2	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction.	Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark	2016	Princeton University Press,

VII(b): Reference Books:

1	Mastering Bitcoins: Unlocking Digital Cryptocurrencies	Andreas Antonopoulos	2013	O'Reilly Media, Inc,

VII(c): Web links and Video Lectures (e-Resources):

- http://bitcoinbook.cs.princeton.edu/?_ga=2.8302578.1344744326.1642688462-86383721.1642688462
- https://nptel.ac.in/courses/106/105/106105184/
- https://ethereum.org/en/developers/
- https://developer.ibm.com/components/hyperledger-fabric/tutorials/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	AEC		
Course Title: Azure AI					
Course Code:	23AIAE41			**Credits:**	01
Teaching Hours/Week (L: T: P: O) {O – Other pedagogies, mention @}			1:0:0:3	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	2.00 Hrs

Pre prerequisite: Understand basic IT concepts, be familiar with cloud computing and Azure fundamentals, have some hands-on experience with cloud platforms, and be aware of career opportunities in cloud computing.

I. Course Objectives:

- To understand the fundamentals of computer vision.
- To develop proficiency in using computer vision libraries.
- To gain the ability to develop and deploy computer vision applications.
- To acquire knowledge of advanced computer vision concepts.
- To gain hands-on experience with real-world projects.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

III. COURSE CONTENT

Module-1: Cloud Computing Fundamentals & Azure Overview	8 Hrs

Introduction: Cloud computing basics, benefits, and models (public, private, hybrid). Cloud storage and differences between providers. Microsoft Azure, its history, key services (VMs, V-Nets), and service types (IaaS, PaaS, SaaS).

RBT Levels: L1, L2, L3, L4	
Module-2: AI Workloads & Machine Learning Basics on Azure	8 Hrs
The features of common AI workloads, the guiding principles for responsible AI, the different types of machine learning, core machine learning concepts, and the capabilities of visual tools in Azure Machine Learning Studio.	
RBT Levels: L1,L2,L3, L4	
Module-3: Computer Vision Workloads on Azure	8 Hrs
Common types of computer vision solutions, including image classification, object detection, optical character recognition (OCR), facial detection, recognition, and facial analysis.	
RBT Levels: L1, L2, L3,L4	
Module-4: Azure Tools for Computer Vision Tasks	8 Hrs
Azure tools and services for computer vision tasks, including the Computer Vision service, Custom Vision service, Face service, and Form Recognizer service, and their respective capabilities.	
RBT Levels: L1, L2, L3,L4	
Module-5: Natural Language Processing Workloads on Azure	8 Hrs
The features of common NLP workload scenarios, Azure tools and services for NLP workloads, and considerations for conversational AI solutions on Azure.	
RBT Levels: L1, L2, L3,L4	

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Explain cloud computing fundamentals and key Azure services.
CO2	Apply AI principles and machine learning basics effectively on Azure.
CO3	Analyze various computer vision solutions on Azure.
CO4	Apply Azure tools for computer vision tasks proficiently.
CO5	Apply NLP workload scenarios and Azure tools for NLP tasks efficiently.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3				3								1			
CO2		3		3										2		2
CO3	2		2													
CO4			3								3				2	
CO5			2								2	2			2	2

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 5

Continuous Internal Evaluation (CIE): Refer Annexure-1section 5

Semester End Examination (SEE): Refer Annexure-1 section 5

VI. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Computer Vision: Algorithms and Applications	Richard Szeliski	First edition 2010	Springer
2	Programming Computer Vision with Python: Tools and algorithms for analyzing images	Jan Erik Solem	First Edition 2012	O'Reilly Media
3	Deep Learning for Computer Vision	Rajalingappaa Shanmugamani	First Edition 2018	Packt Publishing

VII(b): Reference Books:

1	Computer Vision: Models, Learning, and Inference	Simon J. D. Prince	First Edition 2012	Cambridge University Press
2	Computer Vision: A Modern Approach	David A. Forsyth and Jean Ponce	First Edition 2002	Prentice Hall

VII(c): Web links and Video Lectures (e-Resources):

- OpenCV Documentation: [https://docs.opencv.org/]
- Microsoft Learn - Azure AI and Machine Learning: [https://learn.microsoft.com/en-us/azure/ai/]
- PyImageSearch:https://www.pyimagesearch.com/
- Node.js Official Website - [Link](https://nodejs.org/]
- Stanford University - CS231n: Convolutional Neural Networks for Visual Recognition: [http://cs231n.stanford.edu/]

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

seminar, assignments, quiz, case studies, mini projects, industry visit, self-study activities, group discussions, etc

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Department of Artificial Intelligence and Machine Learning

Semester:	IV	**Course Type:**	NCMC		
Course Title: Mindful Mastery : Aptitude And Soft skill Integration					
Course Code:	**23PDSN04**			**Credits:**	PP/NP
Teaching Hours/Week (L: T: P: O) {O – Other pedagogies, mention @}			0:0:0:2	**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	NA	**Total Marks:**	50
SEE Type:	Theory/practical/other assessment			**Exam Hours:**	NA

Pre prerequisite:

I. Course Objectives:

- To gain a deep understanding of numerical concepts including place value, fractions, decimals, percentages, ratios, and proportions.
- To acquire skills to prioritize tasks and activities effectively based on their importance and urgency.
- To develop the ability to interpret and utilize various data representations, including tables, charts, graphs, and diagrams.
- To learn to interpret different body language signals and understand their underlying meanings in interpersonal communication.
- To acquire strategies for breaking down complex problems into manageable steps, enhancing problem-solving abilities.

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. **Diverse Teaching Methods**: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.
2. **Visual Aids**: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.
3. **Collaborative Learning**: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.
4. **Higher Order Thinking (HOT) Questions**: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.
5. **Problem-Based Learning (PBL):** Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.
6. **Multiple Representations**: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.
7. **Creative Problem Solving**: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.
8. **Real-World Application**: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention.

□ Chalk & Talk □ Stud. Assignment □ Web Resources □ LCD/Smart Boards □ Stud. Seminars

III. COURSE CONTENT

Module-1: Arithmetical Ability	6 Hrs
Problems on Pipes Cisterns , Time , Work and Averages	
Module-2: Time management and Presentation skills	4 Hrs

Misconceptions of Time, Symptoms of Poor Time Management, the 'Five Time Zone' Concept, Elements of Effective Time Management. ABC of presentation / Accent and pronunciation / Practice to Perform / Impact of voice modulation, eye contact and body language during presentation. Evaluation, Feed back

Module-3: Quantitative section and Data Interpretation	6 Hrs

Simple interest and compound interest problems, Bar graphs, Pie charts and Line graphs concepts and problem

Module-4: Body language and Postures	4 Hrs

Facial expressions, Gestures, Handshakes, tone of voice, Attitude, Universal vs. Culture specific

Module-5: Mental ability	4 Hrs

Puzzle based question and Psychometric based interview Question

COURSE OUTCOMES: At the end of this course, students will be able to

CO1	Apply problem-solving techniques in Pipes, Cisterns, Time, Work, and Averages, showcasing arithmetical ability.
CO2	Develop efficient time management skills, recognizing misconceptions, symptoms, and implementing effective strategies.
CO3	Apply quantitative analysis and data interpretation, handling problems in simple interest, compound interest, and graphical data interpretation.
CO4	Apply effective body language and postures in communication, distinguishing universal cues from culture-specific ones.
CO5	Apply mental agility through puzzle-solving and psychometric interview preparation, refining problem-solving and cognitive abilities.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1		3		3				2				1	2		1	2
CO2								2	2			2		2		
CO3	3	2						2	2		2	2	2			
CO4						2		2		2		2		2	2	1
CO5	2	2	3									3	1		2	2

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure-1 section 8

Continuous Internal Evaluation (CIE): Refer Annexure-1section 8

Semester End Examination (SEE): Refer Annexure-1 section 8

VI. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1				

VII(b): Reference Books:

1	Quantitative Aptitude for Competitive examination	R S Agarwal	2017	S Chand
2	Gestures and Body Language	Aparna majumdar	2017	V& S Publisher
3	A modern approach to logical reasoning	R S Agarwal	2019	S Chand

VII(c): Web links and Video Lectures (e-Resources):

- https://swayam.gov.in/explorer
- https://nptel.ac.in/courses

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar, group discussions etc.

ANNEXURE

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

CIE & SEE Evaluation strategy for Autonomous Scheme 2023 (Tentative)

Revised/updated on 29/06/2024; the update modifies the practical component evaluation of integrated courses & laboratory courses involving the mini projects or course projects.

Sl. No.	Course Type /Credits	Continuous Internal Evaluation (CIE)																		Semester End Examination (SEE)									Total Marks (CIE+SEE)
		Total CIE marks	Min. Eligty.	I. Theory Component							II. Practical Component									Total CIE marks	Dur. In hrs.	Theory			Practical			Total SEE marks	
				Marks	Min. Eligty.	A. Unit test		B. Formative Assessments		Tot. Theory marks (I)	Marks	Min. Eligty.	C. Weekly Evaluation		D. Internal Test			E. Prj	Tot. marks (II)				Max. cond. marks	Max. considered marks	min. pass %	Max. cond. marks	Max. considered marks	min. pass %		
						Nos.	Marks / Each	Nos.	Marks / Each				Each week	Tot. marks	Nos.	Marks / Each	Total marks	Marks												
1	BSC/ESC/PCC/ETC/ PEC/OEC (3 or 4 Credit courses)	50	50%	50	50%	3	50	2	50	50 (avg. of 5)	--	--	--	--	--	--	--	--	--	50 (I)	03	100	50	40%	--	--	--	50	100
2	IBSC/IESC/IPCC (4 Credit courses)	50	50%	50	50%	3	50	--	--	50 (avg. of 3)	50	50%	50	50 (Avg. of all)	1	50	50	50	50 (Avg. of C & [D or E])	50 (Avg. of I & II)	03	100	50	40%	--	--	--	50	100
3	IESC - CAED (4 credit course)	50	50%	--	--	--	--	--	--	--	50	50%	50	50 (Avg. of all)	1	50	50	--	50 (Avg. of C & D)	50	03	--	--	--	100	50	40%	50	100
4	PCCL (1 Credit courses)	50	50%	--	--	--	--	--	--	--	50	50%	50	50 (Avg. of all)	1	50	50	50	50 (Avg. of C & [D or E])	50 (II)	03	--	--	--	100	50	40%	50	100
5	AEC- IDT, Skill Development courses (1 credit course)	50	50%	50	50%	2	50	1	50	50 (Avg. of 3)	--	--	--	--	--	--	--	--	--	50 (I)	02	50	50	40%	--	--	--	50	100
6	HSMC- CIP, Env studies, SFH, UHV (1 credit course)	50	50%	50	50%	2	50	1	50	50 (Avg. of 3)	--	--	--	--	--	--	--	--	--	50 (I)	02	50	50	40%	--	--	--	50	100
7	HSMC - English, Kannada (No credits)	50	50%	50	50%	2	50	1	50	50 (Avg. of 3)	--	--	--	--	--	--	--	--	--	50 (I)	--	--	--	--	--	--	--	--	50
8	NCMC - Personality Development courses, PE, Yoga, NCC, NSS, IKS (No credits)	50	50%	50	50%	--	--	1	50	50	--	--	--	--	--	--	--	--	--	50 (I)	--	--	--	--	--	--	--	--	50

 # Formative (Successive) Assessments: Assignments/quiz/ seminars/field survey and report presentation/course project/etc. based on the faculty & dept. planning. **# Practical Conduction:** The conduction of each experiment/program per week should evaluate for 50 Marks and average of all shall be taken. **# In case of Integrated course,** minimum eligibility shall be attained as prescribed in both the theory and practical components. **# Self Learning Courses (SLC) Courses, Internship, Mini project & Major Project: Rubrics & Methodology shall be defined seperately**

Academic Dean 22/6/24

Dr. BABU. N.V
Prof. & Academic Dean
SJB Institute of Technology
BGS Health & Education City
Kengeri, Bengaluru-560060

25.6.2024
Principal

Principal
SJB Institute of Technology
67, BGS Health & Education City,
Dr. Vishnuvardhan Road,
Kengeri, Bengaluru - 560 060.

ANNEXURE

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CIE and SEE guidelines based on course Type for Autonomous Scheme 2023

Revised/updated on 29/06/2024; the update modifies the practical component evaluation of integrated courses & laboratory courses involving the mini projects or course projects.

Note:

- **The CIE conduction coordination will be done by the office of Controller of Examination (COE).**
- **The SEE will be conducted by the office of Controller of Examination (COE).**

Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	Final Passing requirement
1. BSC/ESC/PCC/ ETC/PEC/OEC – Theory Course (03 & 04 Credit courses)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test B. Formative assessments	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Duration of 03 hours and total marks of 100. • The question paper will have ten questions. Each question is set for 20 marks. • There will be 2 questions from each module. Each of the two questions under a	The student is declared as a pass in the course if he/she secures a minimum of 45% (45 marks out of 100) in the sum total of the CIE and SEE taken together.

week & 15th week, respectively. • The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. • The student must answer 2 full questions (one from 1st& 2nd questions and another from 3rd& 4th question). • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. **B. Formative assessments:** • 02 formative assessments each of 50 marks shall be conducted by the course coordinator based on the dept. planning during random times. • One formative assessment shall be completed before 5th week and second shall be completed before 12th week. • The syllabus content for the formative assessment shall be defined by the course coordinator. • The formative assessments include Assignments/ Quiz/ seminars/case study/field survey/ report presentation/ course project/etc. • The assignment QP or Quiz QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs & POs and get it approved from academic dean. **The final CIE marks will be 50:** Average of all 05 events of Internal Assessment test and formative assessments. **The documents of all the assessments shall be maintained meticulously.**	module (with a maximum of 3 sub-questions), should have a mix of topics under that module. • The students have to answer 5 full questions, selecting one full question from each module. • Marks scored shall be proportionally reduced to 50 marks.	

2. IBSC/IESC/IPCC – Integrated with Theory & Practical (04 credit courses)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). Minimum eligibility of 50% marks shall be attained separately in both the theory component and practical component. **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have 02 component: I. Theory Component. II. Practical Component. I. Theory Component will consist of A. Internal Assessment Test B. Formative assessments (Not required for Integrated courses) **A. Internal Assessment Test:** • There are 03 tests each of 50 marks conducted during 6th week, 10th week & 15th week, respectively. • The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. • It is suggested to include questions on laboratory content in the Internal Assessment test Question papers. • The student must answer 2 full questions (one from 1st& 2nd questions andanother from 3rd& 4th question). • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. **B. Formative assessments:** • Not required for Integrated courses.	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Only theory SEE for duration of 03 hours and total marks of 100. • The question paper will have ten questions. Each question is set for 20 marks. • There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. • The laboratory content must be included in framing the theory question papers. • The students have to answer 5 full questions, selecting one full question from each module. • Marks scored shall be proportionally reduced to 50 marks. **No Practical SEE for Integrated Course.** Note: CAED Course shall not be considered here, it shall be considered as in sl. No. 3 in the next row	The student is declared as a pass in the course if he/she secures a minimum of 45% (45 marks out of 100) in the sum total of the CIE and SEE taken together.

II. Practical Component: **C.** Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/programs shall be taken.(rubrics will be published by the lab conduction committee) **D.** One laboratoryInternal Assessment test will be conducted during the 14th week for 50 marks.(rubrics will be published by the lab conduction committee) **E.** If the course project / mini project is involved in the laboratory component.**The evaluation shall be completed by 14th week of the semester.** The rubrics required for the evaluation of the project shall be defined by the departments along with mapping of relevant COs & POsand get it approved from academic dean. **Note:** • If component 'E' is involved in the course either component 'D' or 'E' along with component 'C' shall be considered for average of item II. • Otherwise, components 'C' & 'D' shall be considered for average of item II. **The final CIE marks will be 50 =** Avg. {**I** [Avg. of 03 Internal assessment tests] + **II** [Avg. of (C&(Dor E))]} **The documents of all the assessments shall be maintained meticulously.** Note: CAED Course shall not be considered here, it shall be considered as in sl. No. 3 in the next row		
3. IESC: CAED Course (4 credits)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). • CIE shall be conducted for max. marks of 100 and shall be scaled down to 50 marks • CIE component should comprise of both Manual and computer drafting i.e. 50% manual and 50% computer drafting out of total 100 marks	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** SEE for duration of 03 hours and total marks of 100.	The student is declared as a pass in the course if he/she secures a minimum of 45% (45 marks out of 100) in the sum total of the CIE and SEE taken together.

- CIE component should comprise of Continuous evaluation of drawing work of students as and when the modules are covered based on below detailed weightage.

Module	Module Max. Marks	Evaluation Weightage in marks	
		Computer display and print out	Manual Sketching
Module 1	20	10	10
Module 2	20	10	10
Module 3	20	10	10
Module 4	20	10	10
Module 5	20	10	10
TOTAL	**100**	**50**	**50**

- At least one Test covering all the modules is to be conducted for 100 marks during 14th week and the same is to be scaled down to **25 Marks.**
- Assignments = **10 Marks from each module. (50 marks scaled down to 25 Marks)**
- The final CIE 50 marks = Test (25 marks) + Assignment (25 marks).

- SEE shall be conducted and evaluated for maximum marks of 100 and shall be scaled down to 50 marks.
- Question paper shall be made available for each batch asper schedule.
- Evaluation shall be carried jointly by both theinternal & external examiners.
- Scheme of Evaluation: To be defined by both the examiners jointly.
- Maximum 3 questions shall be set as per the following pattern.

From Module			Marks Allotted
Module 01 (Choice between Lines or Planes)			30
Module 02 (Compulsory question)			40
Module 03 or Module 04 or Module 05			30
TOTAL			**100**
Q. No.	**Manual Sketching**	**Computer display and print out**	**TOTAL MARKS**
1	15	15	30
2	20	20	40
3	15	15	30
TOT.	**50**	**50**	**100**

4. PCCL: Laboratory course (01 credit course)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50).

The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks).

The student is declared as a pass in the course if he/she secures a

Continuous Internal Evaluation: CIE will be conducted by the department and it will have only 01 component: I. Theory Component. (Not required for Laboratory course) II. Practical Component. **II. Practical Component:** **C.** Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/program shall be taken (rubrics will be published by the lab conduction committee). **D.** One laboratory Internal Assessment test will be conducted for 50 marks (rubrics will be published by the lab conduction committee). **E.** If the course project / mini project is involved in the laboratory component.**The evaluation shall be completed by 14th week of the semester.** The rubrics required for the evaluation of the project shall be defined by the departments along with mapping of relevant COs & POsand get it approved from academic dean. **Note:** • If component 'E' is involved in the course either component 'D' or 'E' along with component 'C'shall be consideredfor average of item II. • Otherwise, components 'C' & 'D' shall be considered for average of item II. **The final CIE marks will be 50** = Avg. of (C &[D or E]) **The documents of all the assessments shall be maintained meticulously.**	**Semester-End Examination:** Only laboratory SEE will be conducted jointly by the internal examiner and external examiner appointed by COE as per the scheduled timetable for duration of 03 hours. • The examination shall be conducted for 100 marks and shall be reduced to 50 marks proportionately. • All laboratory experiments/programs are to be included for practical examination. • Breakup of marks (Rubrics) and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners (OR) based on the course requirement evaluation rubrics shall be decided jointly by examiners. • Students can pick one question (experiment/program) from the questions lot prepared by the internal /external examiners jointly. • Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. • General rubrics suggested for SEE: writeup-20%, Conduction procedure and results -60%, Viva-voce 20% of maximum marks. • Change of experiment is allowed only once and shall be assessed only for 85% of the maximum marks.	minimum of 45% (45marks out of 100) in the sum total of the CIE and SEE taken together.
5. AEC: Ability Enhancement Courses (01 credit courses)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
The minimum passing mark for the CIE is 50% of the maximum marks	The minimum passing mark for SEE is 40%	The student is declared

(25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test B. Formative assessments **A. Internal Assessment Test:** • There are 02 tests each of 50 marks conducted during 6th week & 15th week, respectively. • The question paper will be of Multiple-Choice Questions (MCQ). • The student must answer all questions. • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course **B. Formative assessments:** • 01 formative assessments of 50 marks shall be conducted by the Course coordinator based on the dept. planning before 14th week. • The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. • The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs &POs. **The final CIE marks will be 50:** Average of all 03 events (02 Internal Assessment test and 01 formative assessment). **The documents of all the assessments shall be maintained meticulously.**	of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Theory SEE will be conducted by COE as per the scheduled timetable for duration of 02 hours and total marks of 50. • Multiple choice Question paper. • The students have to answer all questions.	as a pass in the course if he/she secures a minimum of 45% (45marks out of 100) in the sum total of the CIE and SEE taken together.
6. HSMC: (01 credit course)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test B. Formative assessments **A. Internal Assessment Test:** • There are 02 tests each of 50 marks conducted during 6th week & 15th week, respectively. • The question paper will be of Multiple-Choice Questions (MCQ). • The student must answer all questions. • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course **B. Formative assessments:** • 01 formative assessments of 50 marks shall be conducted by the faculty based on the dept. planning before 14th week. • The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. • The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs &POs. **The final CIE marks will be 50:** Average of all 03 events (02 IA test and 01 formative assessment). **The documents of all the assessments shall be maintained meticulously.**	The minimum passing mark for SEE is 40% of the maximum marks (20 out of 50 marks). **Semester-End Examination:** Theory SEE will be conducted by COE as per the scheduled timetable for duration of 02 hours and total marks of 50. • Multiple choice Question paper. • The students have to answer all questions. • Marks scored shall be proportionally reduced to 50 marks.	The student is declared as a pass in the course if he/she secures a minimum of 45% (45 marks out of 100) in the sum total of the CIE and SEE taken together.
7. HSMC: (0 credit courses)		

The weightage is only for Continuous Internal Evaluation (CIE).		
The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of C. Internal Assessment Test D. Formative assessments **A. Internal Assessment Test:** • There are 02 tests each of 50 marks conducted during 6th week & 15th week, respectively. • The question paper will be of Multiple-Choice Questions (MCQ). • The student must answer all questions. • Internal Assessment Test question paper shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course **B. Formative assessments:** • 01 formative assessments of 50 marks shall be conducted by the faculty based on the dept. planning during random times. • The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. • The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs &POs. **The final CIE marks will be 50** = Average of all 03 events (02 IA test and 01 formative assessment). **The documents of all the assessments shall be maintained meticulously.**	• No Semester End Examination.	The student is declared as a pass in the course if he/she secures a minimum of 50% (25 marks out of 50) in the CIE.
8. NCMC: (0 credit course)		
The weightage is only for Continuous Internal Evaluation (CIE).		

The minimum passing mark for the CIE is 50% of the maximum marks (25 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of only 01 assessment A. Internal Assessment Test (not required for NCMC course). B. Formative assessments. **B. Formative assessments:** • 01 formative assessments of 50 marks shall be conducted by the faculty based on the dept. planning during random times. • The formative assessments include Quiz/Assignments/seminars/case study/field survey/ report presentation/course project/etc. • The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. • The rubrics required for the other formal assessments shall be defined by the departments along with mapping of relevant COs &POs. **The final CIE marks will be 50** **The documents of all the assessments shall be maintained meticulously.**	• No Semester End Examination.	The student is declared as a pass in the course if he/she secures a minimum of 50% (25 marks out of 50) in the CIE.

Academic Dean
Dr. Babu N.V

DR. BABU N.V
Prof. & Academic Dean
SJB Institute of Technology
BGS Health & Education City
Kengeri, Bengaluru-560060

25.6.2019

Principal
Dr. K V Mahendra Prashanth

Principal
SJB Institute of Technology
67, BGS Health & Education City,
Dr. Vishnuvardhan Road,
Kengeri, Bengaluru - 560 060.

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Program Outcomes (POs)- Graduate Attributes

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 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 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 engineering practice.

9. **Individual and teamwork**: 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.

|| Jai Shree Gurudev ||
Sri Adichunchanagiri Shikshana Trust ®

SJB Institute of Technology

BGS Health and Education City,
Dr. Vishnuvardhan Road, kengeri,
Bengaluru – 560060

+91-80-28612445 / 46

https://sjbit.edu.in/

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ATAL Ranking:
Band Performer

Band of 151 to 300 in
Innovation Category