|| 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

B.E.

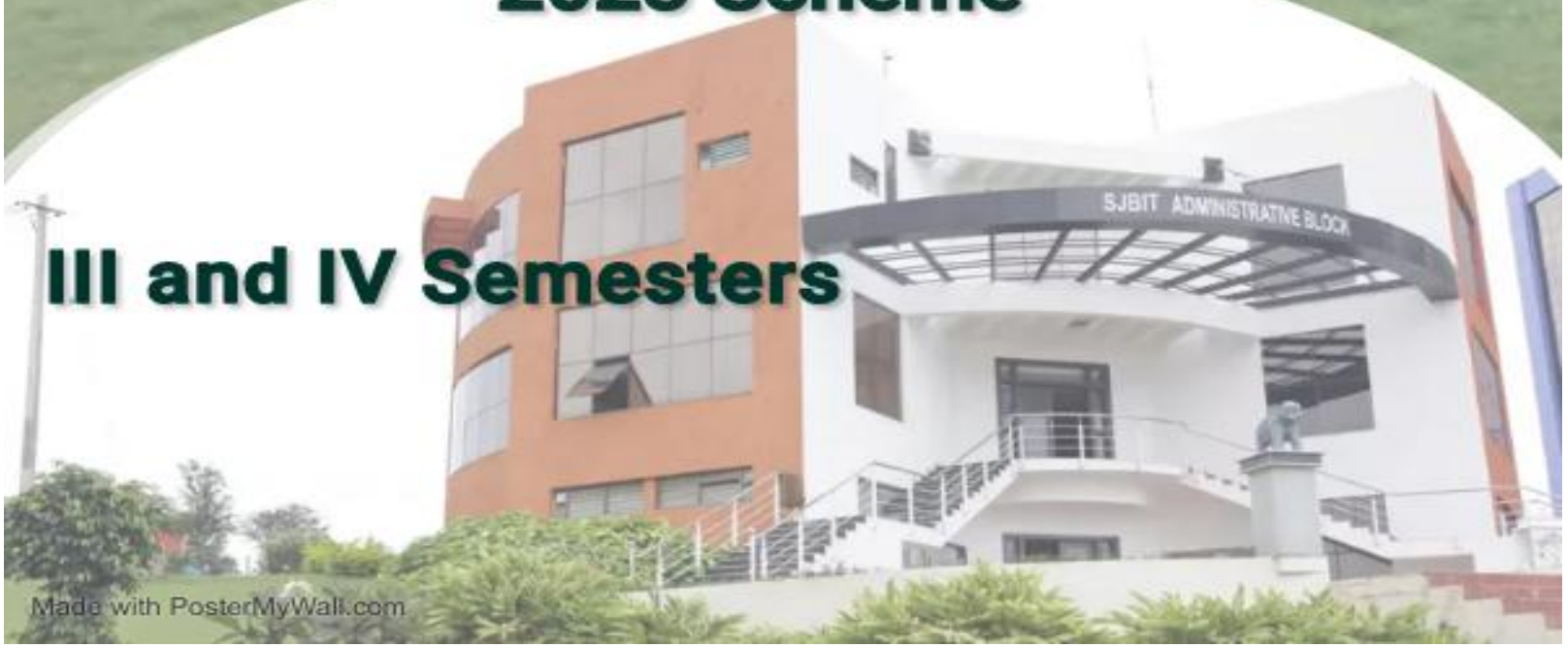
Autonomous Scheme & Syllabus

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Second Year - Scheme and Syllabus

2023 Scheme

III and IV Semesters



SERVICE TO MANKIND IS SERVICE TO GOD

His Divine Soul Padmabhushana

Sri Sri Sri Dr. Balagangadharanath MahaSwamiji

Founder President, Sri Adichunchanagiri Shikshana Trust®

"Life needs mundane knowledge
Salvation needs spiritual knowledge
They together banish our pervading ignorance"

His Holiness Parama Pujya

Sri Sri Sri Dr. Nirmalanandanatha MahaSwamiji

President, Sri Adichunchanagiri Shikshana Trust ®

"Every youth wants to be unique - that is you!"

Revered Sri Sri Dr. Prakashanatha Swamiji

Managing Director, BGS & SJB Group of Institutions & Hospitals

"Knowledge gives discipline, from discipline comes worthiness, from worthiness one gets wealth, from wealth (one does) good deeds, from that (comes) joy."

" सा विद्या या विमुक्तये "

" Sa Vidya Ya Vimuktaye – that which liberates is Knowledge "

INSTITUTE VISION:
To become a recognized technical education center with a global perspective.

INSTITUTE 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:
We envision our department as a catalyst for developing educated, engaged and employable individuals whose collective energy will be the driving force for prosperity and the quality of life in our diverse world

DEPARTMENT MISSION
Our mission is to provide quality technical education in the field of information technology and to strive for excellence in the education by developing and sharpening the intellectual and human potential for good industry and community.

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 Information Science and Engineering

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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: 2024-25 ISE

SCHEME: 2023 **SEM: III** **Revision date: 8/30/2024**

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	23ISI301	Discrete Mathematics and Graph Theory	Maths	Maths	4	2	2	2	@	50	03	50	-	100
2	PCC	1	23IST302	Data Structures using C	Dept.	Dept.	3	2	2	0		50	03	50	-	100
3	IPCC	1	23ISI303	Computer Organization & ARM Microcontroller	Dept.	Dept.	4	3	0	2	@	50	03	50	-	100
4	IPCC	2	23ISI304	OOPS with C++	Dept.	Dept.	4	3	0	2	@	50	03	50	-	100
5	PCCL	1	23ISL305	Data Structures Lab using C	Dept.	Dept.	1	0	0	2		50	03	-	50	100
6	ETC	1	23ISE31y	Emerging Technology Course - 1	Dept.	Dept.	3	3	0	0	@	50	03	50	-	100
7	AEC	3	23ISAE31	Data Science using Python	I.E.	I.E.	1	1	0	0	3	50	02	50	-	100
8	NCMC	3	23PDSN03	Skillfull Futures: Empowering Aptitude and softskills	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**
23ISE311	Fundamentals of Mobile Computing
23ISE312	Visualization and Computational foundations for data science
23ISE313	Fundamentals of Artificial Intelligence
23ISE314	The Fundamentals of Block Chain Technology

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

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	O	CIE Marks	SEE			Tot. Marks
								Lecture	Tutorial	Practical	PBL/ABL/ SL/othrs.		Dur.	Th. Mrks	Lab. Mrks.	
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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Department of Information Science & Engineering

Self Learning course list for UG BE - 2024

SCHEME: 2023 **Release date: 25-06-2024**

Self-Learning course - 1 (NPTEL) (23ISS1yy)			Self-Learning course - 2 (NPTEL) (23ISS1yy)		
Course Code	Course Title	NPTEL Code	Course Code	Course Title	NPTEL Code
23ISS101	Computer Architecture	noc24-cs83	23ISS201	Patent Law for Engineers and Scientists	noc24-hs155
23ISS102	Advanced Distributed Systems	noc24-cs99	23ISS202	E-Business	noc24-mg92
23ISS103	Getting Started with Competitive Programming	noc24-cs103	23ISS203	Advanced R Programming for Data Analytics in Business	noc24-mg113
23ISS104	Social Network Analysis	noc24-cs90	23ISS204	Regression Analysis	noc24-ma82
23ISS105	Deep Learning	noc24-cs114	23ISS205	Foundations of R Software	noc24-ma95
23ISS106	C-Based VLSI Design	noc24-cs122	23ISS206	Probability Theory for Data Science	noc24-ma64
23ISS107	Computer Vision	noc24-cs124	23ISS207	Introduction To Probability Theory And Stochastic Processes	noc24-ma97
23ISS108	Algorithmic Game Theory	noc24-cs109	23ISS208	5G Wireless Standard Design	noc24-ee152
23ISS109	Responsible & Safe AI Systems	noc24-cs132	23ISS209	Medical Image Analysis	noc24-bt53
23ISS110	Text, Textuality and Digital Media	noc24-hs122	23ISS210	Pattern Recognition and Application	noc24-ee118

25/6/24
HOD
Head of the Department
Dept. of Information Science & Engineering
S.J.B. Institute of Technology
Kengeri, Bangalore-560 060

26/6/24
Academic Dean
Dr. BABU. N.V
Prof & Academic Dean
SJB Institute of Technology
BGS Health & Education City
Kengeri, Bengaluru-560060

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

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: 2024-25 ISE

SCHEME: 2023 **SEM: IV** **Revision date: 8/30/2024**

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O		SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/AB L/ SL/etc.	CIE Marks	Dur.	Th.	Lab	Tot.
1	BSC	4	23IST401	Probability Distributions and Statistical methods	Maths	Maths	**3**	2	2	0	@	50	03	50	-	100
2	PCC	2	23IST402	Design and Analysis of Algorithm	Dept.	Dept.	**3**	2	2	0		50	03	50	-	100
3	IPCC	3	23ISI403	Computer Networks	Dept.	Dept.	**4**	3	0	2	@	50	03	50	-	100
4	IPCC	4	23ISI404	Operating System	Dept.	Dept.	**4**	3	0	2	@	50	03	50	-	100
5	PCCL	2	23ISL405	Design and Analysis of Algorithm Lab using JAVA	Dept.	Dept.	**1**	0	0	2		50	03	-	50	100
6	ETC	2	23ISE42y	Emerging Technology Course - 2	Dept.	Dept.	**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	23ISAE41	Java Programming	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**	**14**	**6**	**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**
23ISE421	Cyber Security and Cyber laws
23ISE422	Business Intelligence and applications
23ISE423	Fuzzy Logic and Neural Networks
23ISE424	Block chain for business

Semester:	III	**Course Type:**	IBSC		
Course Title: Discrete Mathematics and Graph Theory					
Course Code:	**23ISI301**			**Credits:**	4
Teaching Hours/Week (L:T:P:O)			2:2:2:@	**Total Hours:**	40+ Lab slots
CIE Marks:	50	**SEE Marks:**	100	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- 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	8 Hours

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.

*** Applications problems to be excluded for SEE.**

Textbook 2: Chapter1.1, 1.2, 1.3, 1.5.

Self Learning: Applications to switching Networks

RBT Levels:L1, L2 and L3

Module-2: Principles of counting	8 Hours
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. *** Applications problems to be excluded for SEE.**	
Textbook 1: Chapter4.1.	
Self Learning: The Catalan Numbers.	
RBT Levels:L1, L2 and L3	
Module-3: Relations and Functions	8 Hours
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. *** Applications 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	8 Hours
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements and Graph Isomorphism. Vertex degree: Euler trails and circuits, planar graphs,sets to bond .Graph coloring and chromatic polynomials. Illustrative examples on Traveling salesman problem. *** Illustrative examples to be excluded for SEE.**	
Textbook 1: Chapter11.1, 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	8 Hours
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. *** Applications 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	

VI. Learning Resources

III(B) Practical Part	
Sl.No.	**Experiments**
1	Write a 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	Write a 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	Write a 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 approachto 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'stheorem, find the minimum vertex cut between source and target.
IV .COURSE OUTCOMES	
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	S 1	S 2	S 3	S4
CO1	3	2	1		1							1				
CO2	3	2	1		1							1				
CO3	3	2	1		1							1				
CO4	3	2	1		1							1				
CO5	3	2	1		1							1				

V. Assessment Details (CIE & SEE)

General Rules: Refer annexure section 2

Continuous Internal Evaluation (CIE)&Rubics: Refer annexure section 2

Semester End Examination (SEE): Refer annexure section 2

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/ 4. VTU EDUSAT programme-20				
VIII: Activity Based Learning				
Assignments, Quiz, Presentation.				

Semester:	III	**Course Type:**	PCC		
Course Title: Data Structures using C					
Course Code:	23IST302			**Credits:**	03
Teaching Hours/Week (L: T: P: O)			2:2:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- Explain the fundamentals of data structures and their applications essential for implementing solutions to problems.
- Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
- Design and Develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists.
- Explore usage of Trees and Graph for application development.
- Apply the Hashing techniques in mapping key value pairs.

II. Teaching-Learning Process (General Instructions):

1. These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. 1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it

III. COURSE CONTENT

Module-1: Introduction to Data Structure	**8 Hours**

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 arrays

Textbook: Chapter: sections: Textbook 1: Chapter 1: 1.2, Chapter 2: 2.3 - 2.5, Text Textbook 2: Chapter 1: 1.1 - 1.4,
Pre-requisites (Self Learning): Problem based learning (Implementation of different programs to illustrate application of arrays and structures). https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html https://ds1-iiith.vlabs.ac.in/data-structures1/List%20of%20experiments.html
RBT Levels: L1, L2

Module-2: Stack and Queues	**8 Hours**

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.
Textbook: Chapter: sections: Textbook 1: Chapter 3: 3.1 -3.4, 3.6
Pre-requisites (Self Learning): Active Learning, Problem based learning https://nptel.ac.in/courses/106/102/106102064/ https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
RBT Levels: L1, L2, L3,L4

Module-3: Linked List	**8 Hours**

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.
Textbook: Chapter: Sections: Textbook 1: Chapter 4: 4.1 – 4.4, 4.5.2, 4.7, 4.8
Pre-requisites (Self Learning) MOOC, Problem solving based on linked lists. https://nptel.ac.in/courses/106/102/106102064/ https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
RBT Levels: L3, L4, L6

Module-4: Trees	**8 Hours**

Trees : Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression.

Textbook: Chapter: sections: Textbook 1: Chapter 5: 5.1 –5.3,5.5, 5.7

Pre-requisites (Self Learning): Problem based learning
http://www.nptelvideos.in/2012/11/data-structures-andalgorithms.html

RBT Levels: L2, L3, L4,L6

Module-5: Graphs and Hashing	**8 Hours**

Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing

Textbook: Chapter: Textbook 1: Chapter 6 : 6.1–6.2.1,6.2.2, Chapter 8 : 8.1-8.3

Pre-requisites (Self Learning): NPTL, MOOC etc. courses on trees and graphs. http://www.nptelvideos.in/2012/11/data-structures-andalgorithms.html

RBT Levels: L2, L3, L4

IV. COURSE OUTCOMES

Students will be able to

CO1	To explain the principles of data structures and their uses.
CO2	Apply stack and queues in solving problems.
CO3	Demonstrate applications of linked list
CO4	Explore how trees can be used and find a solution in real-world problem.
CO5	Utilize hashing and graphing techniques to handle collisions while mapping important value pairs.

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**	**S4**
CO1			1		1						1	1	2			
CO2		2	1	2	1						1	1	2			
CO3	1		1	1	1						1	1	2			
CO4	2	1	2	1	2						1	1	2			
CO5	1	2	2	1	1						1	1	2			

VI.

General Rules: Refer Annexure section-1

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**	**Edition and Year**

1	Fundamentals of Data Structures in C	Ellis Horowitz and Sartaj Sahni	Universities Press	2nd Ed,2014
VII(b): Reference Books: (Insert or delete rows as per requirement)				
1	Data Structures: A Pseudo-code approach with C	Gilberg and Forouzan	Cengage Learning	2nd Ed,2014
2	An Introduction to Data Structures with Applications	Jean-Paul Tremblay & Paul G. Sorenson	McGraw Hill	2nd Ed,2013

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

1. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2. https://nptel.ac.in/courses/106/105/106105171/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

VIII: Activity Based Learning

1. Real world problem solving using group discussion.
2. Back/Forward stacks on browsers.
3. Undo/Redo stacks in Excel or Word.
4. Linked list representation of real-world queues -Music player, image viewer

Semester:	III	**Course Type:**	IPCC		
Course Title: Computer Organization & ARM Microcontroller					
Course Code:	23ISI303			**Credits:**	04
Teaching Hours/Week (L:T:P:O)			3:0:2:@	**Total Hours:**	40 + Lab Slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives

Students Will be able to:

- Understand the basics organisation of computer system and its subsystems
- Describe the architectural features and instructions ARM Cortex M3
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system

II. Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Classical teaching methods- chalk and talk
- ICT- presentations, Keynote, Videos, animations
- Periodical assignments for better understanding
- ABL and PBL

III(a). COURSE CONTENT

Module-1: Basics of Computer Organization	8 Hours

Basics of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate

Input/Output Organization: Accessing I/O Devices, , Direct Memory Access, Buses, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

Textbook: Chapter: sections: Text Book 1: Chapter 1,2,4 : 1.3 to 1.6, 2.2 to 2.10, 4.1 to 4.7

Pre-requisites (Self Learning): Knowledge on Computer architecture, processing elements, data transfer process, Performance parameter of computers

RBT Levels:L1, L2

Module-2: Processing Unit and Memory	8 Hours
Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. **Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions	
Textbook: Chapter: sections: Text Book 1: Chapter 7 and 8	
Pre-requisites (Self Learning): LearnBasic concepts of pipelining, difference between RAM and ROM, types of memory.	
RBT Levels: L1, L2	
Module-3: ARM Embedded Systems	8 Hours
Introduction, ARM designs philosophy, Embedded system hardware, Operating System, Applications. ARM Processor Fundamentals, ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions	
Textbook: Chapter: Sections: Text Book 2: Chapter 1 and 2	
Pre-requisites (Self Learning): Difference between RISC and CISC**,** RISC design philosophy	
RBT Levels:L1, L2, L3	
Module-4: ARM Instruction set	8 Hours
Introduction, Data processing instructions, Load – Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution. Case study: Recent trends in aeronautical/defense domain using ARM or other advanced microcontroller.	
Textbook: Chapter: sections: Text Book 2: Chapter 3	
Pre-requisites (Self Learning): Types/categories of instructions	
RBT Levels: L1, L2, L3	
Module-5: THUMB instruction set & C Programming	8 Hours
Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. **Efficient C Programming**: Basic C Data types, C looping structures Comparative study: Compare one data processing task with Assembly language and with C language.	
Textbook: Chapter: Text book 2: Chapter 4 and 5	
Pre-requisites (Self Learning): Overview of C Compilers and optimization	
RBT Levels:L1, L2, L3	

III(b). PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1.	Illustrate the operation of multiplication and addition operations (16 bit)

2.	Write ALP to transfer data from one location to another using internal RAM
3.	Write an ALP to find the sum of first 10 integer numbers
4.	Write an ALP to find factorial of a number
5.	Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
6.	Write ALP to find square of a given number using look up table
7.	Write an ALP to count the number of ones and zeros in two consecutive memory locations.
8.	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction
9.	Interface a DAC and generate Triangular and Square waveforms.
10.	Interface a DC motor to and write ALP to control its speed.

IV. COURSE OUTCOMES

CO1	Describe the needs, architecture and applications of computer organisation & ARM microcontroller
CO2	Explain the different subsystems of computer organisation optimally.
CO3	Write assembly level programs to solve different problems and requirements using ARM microcontrollers.
CO4	Apply the concepts of C programming &THUMB instructions for data processing

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	S4
CO1	2	2	1							2	2	1	2			
CO2	2	2	1							2	2	1	2			
CO3	2	2	1		2					2	2	1	2			
CO4	2	2	1		2					2	2	1	2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 2

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	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw Hill	5th Edition, 2002
2	ARM System Developers Guide	Andrew N Sloss, Dominic System and Chris Wright	Elsevier, Morgan Kaufman publisher	1st Edition, 2008

VII(b): Reference Books:

1	Advanced Microprocessors and Peripherals	A. K. Ray and K.M. Bhurchandani	MHE	2nd Edition 2006
2	ARM System Developers guide	ndrew N SLOSS, Dominic SYMES, Chris WRIGHT	Elsevier	2012

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

1. http://nptel.ac.in/courses/108107029/
2. http://www.engineersgarage.com
3. www.microcontroller.com

VIII: Activity Based Learning

1. Students to practice more of programming
2. Activity based learning
3. Project based learning

Semester:	3	**Course Type:**	IPCC		
Course Title: OOPS with C++					
Course Code:	23ISI304			**Credits:**	4
Teaching Hours/Week (L:T:P:O)			3:0:2:@	**Total Hours:**	40 +Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- Introduction to the Object-Oriented Programming concepts using the C++ language.
- Implement classes, objects and functions using C++.
- Demonstrate the significance of constructors, destructor and operator overloading.
- Understanding the principles of inheritance.
- Apply the principles of virtual functions and polymorphism, process data in files using file I/O functions.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.
1. Chalk and board, power point presentations
2. Online material (Tutorials) and video lectures.
3. Demonstration of programming examples.

III(a). COURSE CONTENT

Module-1: Overview of C++, Class and Objects — 8 Hours

An overview of C++: What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program.

Classes and Objects: Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment

Textbook:1 Chapters:11(page no.:255-266,288),12.

Pre-requisites: Basics of C

RBT Levels: L1,L2

Module-2: Arrays, Pointers, Function Overloading and Constructor.	8 Hours
Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, This Pointer, Pointers to derived types, Pointers to class members. **Function Overloading, Copy Constructors:** Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.	
Textbook:1 Chapters: 13,14.	
Pre-requisites: Basics of C	
RBT Levels: L1,L2	
Module-3: Operator Overloading and Inheritance.	8 Hours
Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, overloading new and delete **Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.	
Textbook: 1 Chapters: 15,16	
Pre-requisites: Knowledge on Class and Objects	
RBT Levels: L1,L2	
Module-4: Virtual Functions, Polymorphism and Templates	8 Hours
Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. **Templates**: Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates	
Textbook:1 Chapters: 17,18.	
Pre-requisites: Knowledge about Inheritance	
RBT Levels: L1,L2,L3	
Module-5: Exception Handling and File I/O	8 Hours
Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. **File I/O:**<fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.	
Textbook:1Chapters: 19,21.	
Pre-requisites: File operation's	
RBT Levels: L1,L2,L3	
III(b). Practical content	

1. Develop a C++ program to find the largest of three numbers
2. Develop a C++ program to sort the elements in ascending and descending order.
3. Develop a C++ program using classes to display student name, roll number, marks obtained in two subjects and total score of students
4. Develop a C++ program to demonstrate function overloading for the following prototypes. Add (int a, int b) Add (double a, double b)
5. Develop a C++ program using Operator Overloading for overloading Unary minus operator.
6. Develop a C++ program to implement Multiple inheritance for performing arithmetic operation of two numbers
7. Develop a C++ program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
8. Write a C++ program to derive a class publicly from base class. Declare base class members under public, private and protected
9. Write a C++ program to demonstrate friend function and friend class.
10. Develop a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.
11. Develop a C++ program to declare virtual base class. Derive a class using two virtual classes.
12. Develop a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.

IV. COURSE OUTCOMES

CO1	Students will be able to Illustrate the basic concepts of object-oriented programming.
CO2	Design appropriate classes for the given real-world scenario.
CO3	Learn the knowledge of inheritance for developing optimized solutions.
CO4	Apply the knowledge of compile-time / run-time polymorphism to solve the given problem.
CO5	Apply the concepts of Exceptional Handling for the given problem and File operations.

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	S4
CO1	3															
CO2	3		2	2												
CO3	3		2	2									1			
CO4		2	2	2									1			
CO5		2	2										1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- section 2

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	The Complete Reference C++	Schildt Herbert	Tata McGraw Hill Publication	4th Edition, 2009.
VII(b): Reference Books:				
1	Object Oriented programming with C++	E Balaguruaswamy	Tata McGraw Hill	5th Edition, 2008.
2	The C++ Programming Language	Bjarne Stroustrup	Special Edition,	Pearson Education, 2004.

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

1. Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2. Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. https://www.edx.org/course/introduction-to-c-3
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview

VIII: Activity Based Learning

1. Group Assignment to develop small projects and demonstrate using C++

Semester:	III	**Course Type:**	PCCL		
Course Title: Data Structures Lab using C					
Course Code:	23ISL305			**Credits:**	1
Teaching Hours/Week(L:T:P: O)			0:0:2:0	**Total Hours:**	Lab Slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	3

I. Course Objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Dynamic memory management.
- Linear data structures and their applications such as stacks, queues and lists.
- Non-Linear data structures and their applications such as trees and graphs.

II. Teaching-Learning Process (General Instructions)

- Implement all the programs in "C" Programming Language and Linux OS.
- Experiential Learning
- PBL an ABL
- Video lectures/animations
- Traditional Teaching methods

III. PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1.	Design, Develop and Implement a menu driven Program in C for the following Array operations a. Inserting an Element(ELEM)at a given valid Position(POS) b. Deleting an Element at a given valid Position(POS) c. Display of Array Elements d. Exit. Support the program with functions for each of the above operations.

2.	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations.
3.	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators:+,-,*,/,%,^ b. 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) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
5.	Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: *SSN, Name, Dept, Designation, Sal, PhNo* a. Create a DLL of N Employees Data by using *end insertion*. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
6.	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree(BST) of Integers a. Create a BST of N Integers b. Traverse the BST in Inorder, Preorder and Post Order.
7.	Design, Develop and implement a program in C for the following operations on Graph (G) of cities a. Create a Graph of N cities using Adjacency Matrix. b. 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)=KMod 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 should develop 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.

IV .COURSEOUTCOMES

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

V .CO-PO-PSOMAPPING (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									2		
CO2	2	1	2	1	2									2		
CO3	2	1	2	1	2									2		
CO4	2	1	2	1	2									2		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure - Section 4

Continuous Internal Evaluation (CIE): Refer Annexure - Section 4

Semester End Examination (SEE): Refer Annexure - Section 4

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

1. https://www.geeksforgeeks.org/realtime-application-of-data-structures
2. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
3. https://nptel.ac.in/courses/106/105/106105171/
4. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

VII(b): Activity Based Learning

1. Students to practice more of programming.
2. Linked list representation of real-world queues -Music player, image viewer.
3. Project Based Learning.

Semester:	III	**Course Type:**	ETC		
Course Title: Fundamentals of Mobile Computing					
Course Code:	23ISE311			**Credits:**	**3**
Teaching Hours/Week (L: T: P: O)			**3:0:0:0**	**Total Hours:**	03
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	**3**

I. Course Objectives

- To impart basic understanding of the wireless communication systems.
- To expose students to various aspects of mobile and ad-hoc networks.

II. Teaching-Learning Process (General Instructions)

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by Chalk and Talk or PPTs, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on basis of continuous evaluation of students in class-room.
3. Students will use supplementary resources such as online videos, NPTEL videos, e-courses.
4. Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.

III. COURSE CONTENT

Module-1: Introduction to Networks — **8 Hours**

Networks, Internet History, Protocol Standards and Administration, Layered Tasks, Networks Models: The OSI model, TCP/IP Protocol suite. Mobile Adhoc Networks, Characteristics, Basic Routing schemes, Classification, Security in Adhoc Networks.

Textbook: 1- Chapter 1.2 to 1.4, 2.1 to 2.4, Textbook 2: Chapter: 5.1 to 5.6

Pre-requisites (Self Learning): Evolution of Wired Networks

RBT Levels: L1, L2

Module-2: Introduction to Mobile Computing and its Architecture — **8 Hours**

Introduction, Existing Cellular Network Architecture, Cellular Digital Packet Data Technology, Issues in Cellular Networks, Constraints in Mobile Computing, Applications, Generations of Mobile Wireless Technologies, Mobile Wireless Protocols.

Architecture of Mobile Computing, Three-tier Architecture, Design Considerations, Mobile computing through Internet, Bluetooth, RFID, WiMAX, Mobile IP, IPv6.

Textbook: 2- Chapter -1.1 to 1.10, Textbook: 4 – Chapter 2.4 to 2.7, 4.1 to 4.6

Pre-requisites (Self Learning) – Introduction of Wireless Networks & Evolution	
RBT Levels: L2, L3, L4	
Module-3: GSM & GPRS for Communication, Mobile OS	**8 Hours**
Mobile Computing – Characteristics, Applications, Structure, GSM, GPRS, UMTS Mobile OS – Responsibilities in Mobile computing, Basic concepts, Constraints & requirements, Survey of Mobile OS, Comparative study of Mobile OS, OS for Sensor networks.	
Textbook 3: Chapter 2.2 to 2.9, 9.2 to 9.5	
Pre-requisites (Self Learning) – Basics of Wireless Communication and Operating System	
RBT Levels: L1, L2	
Module-4: Mobile Data Management & Location Management	**8 Hours**
Data Communications & Mobility, Mobile Vs Stationary Environment, Mobile Data Management Issues, Mobility Management Issues in 4G Networks, Data replication in Mobile Computing. Location based services, General Issues in Location Management, Location Management in Wireless Networks.	
Textbook 2: – Chapter 2.1 to 2.5, Chapter 3.2 to 3.4	
Pre-requisites (Self Learning) Basics of Memory Management and Networking	
RBT Levels:L1, L2, L3	
Module-5: Mobile Transaction Management, Mobile IP, Security Issues	**8 Hours**
Database & Transaction concepts, Mobile Transaction Processing, Mobile IP, Features, Mechanism in Mobile IP, Security Techniques & Algorithms, Security Protocols, Security Models & Framework.	
Textbook3: Ch 4.1, 4.3, 4.4, 4.5, Chapter 6.4, 6.5, 6.6, Textbook4: Ch 20.3, 20.4, 20.7, 20.8	
Pre-requisites (Self Learning) – Basics of Networking Security	
RBT Levels: L2, L3, L4	

IV. COURSE OUTCOMES

After the completion of the course, the student will be able to:

CO1	Apply the knowledge of networking and routing schemes in communication
CO2	Describe and analyze existing frameworks with architectures to utilize mobile computing
CO3	Explain various technology trends for next generation cellular wireless networks.
CO4	Evaluate the effectiveness of different mobile computing frameworks
CO5	Interpret the Transactions and Security Issues in mobile computing.

V. CO-PO-PSO MAPPING (Note: 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	1									2			
CO2	2	1	1	1									1			
CO3	2	1	1	1									1			

CO4	2	1	1	1									1			
CO5	2	1	1	1									2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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	Edition and Year
1	Communications and Networking	Behrouz A. Forouzan	Tata McGraw Hill	4th Edition. 2017.
2	Mobile Computing	Brijesh Gupta	Khanna Book	2nd Edition, 2020
3	Fundamentals of Mobile Computing	Prasant Kumar Patnaik	PHI Learning Pvt. Ltd.	1st Edition, 2012
4	Mobile Computing	Asoke Talukder, Hasan Ahmed Roopa R Yavagal	Tata McGraw Hill	2nd Edition, 2010

VII(b): Reference Books:

1	Mobile Computing Theory and Practice	Kumkum Garg	Pearson Publications	1st Edition
2	Principles of Mobile Computing and Communications	Mazliza Othman	Auerbach Publications	1st Edition
3	Handbook of Wireless Networks and Mobile Computing	Stojmenovic and Cacute	Wiley Publications	1st Edition

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

1. Mobile Computing - Course (nptel.ac.in)
2. Mobile Computing | Edge Computing Lab (harvard.edu)
3. Mobile Computing: Introduction – Mobile Computing (inflibnet.ac.in)

VIII: Activity Based Learning

1. Prepare and Present presentation on different mobile technology and on Open Source Technology.
2. Prepare comparison of technical features of different mobile communication Technologies being used by popular service providers (such as BSNL, Reliance, Vodafone, Airtel etc.) in your city/town

Semester:	III	**Course Type:**	ETC		
Course Title: Visualization and Computational Foundations for Data Science					
Course Code:	23ISE312			**Credits:**	03
Teaching Hours/Week (L: T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives

- To introduce data collection and pre-processing techniques for data science
- Explore analytical methods for solving real life problems through data exploration techniques
- Illustrate different types of data and its visualization
- Find different data visualization techniques and tools
- Design and map element of visualization well to perceive information

II. Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT

III(a). Theory PART

Module-1:Introduction to Data Science	8 Hours

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model.	
Textbook 1: Chapter 1, Chapter 2	
Pre-requisites (Self Learning): Basic understanding of Computers and knowledge of Data Science.	
RBT Levels: L1, L2	
Module-2:Exploratory Data Analysis and the Data Science Process	8 Hours
Philosophy of EDA, The Data Science Process, Case Study: Real Direct(online realestate firm). ThreeBasic Machine LearningAlgorithms: Linear Regression, k-Nearest Neighbours (k- NN), k-means.	
Textbook 1: Chapter 2, Chapter 3	
Pre-requisites (Self Learning): Fundamentals of Data Science.	
RBT Levels: L2, L3	
Module-3:Feature Generation and Feature Selection	8 Hours
Extracting Meaning from Data: Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.	
Textbook 1: Chapter 7, Chapter 8	
Pre-requisites (Self Learning): Basic understanding of Search engines.	
RBT Levels: L3, L4	
Module-4:Data Visualization and Data Exploration	8 Hours
Introduction: Data Visualization, Importance of Data Visualization, Data Wrangling, Tools and Libraries for Visualization **Comparison Plots**: Line Chart, Bar Chart and Radar Chart; **Relation Plots**: Scatter Plot, Bubble Plot, Correlogram and Heatmap; **Composition Plots**: Pie Chart, Stacked Bar Chart, Stacked Area Chart, Venn Diagram; **Distribution Plots**: Histogram, Density Plot, Box Plot, Violin Plot; **Geo Plots**: Dot Map, Choropleth Map, Connection Map; What Makes a Good Visualization?	
Textbook 2: Chapter 1, Chapter 2	
Pre-requisites (Self Learning): Knowledge of Charts and Plots.	
RBT Levels: L2, L3	
Module-5: Introduction to Tableau	8 Hours

An introduction to Connecting to Data: An Introduction to Connecting to Data in Tableau**, Shaping Data for Use with Tableau, Getting a Lay of the Land:** Tableau Terminology, View the Underlying Data, View the Number of Records; **Dimension Versus Measure:** What is Measure? What is a Dimension? **Discrete Versus Continuous; Five Ways to Make a Bar Chart/ An Introduction to Aggregation:** Five ways to Create a Bar Chart in Tableau, An Introduction to Aggregation in Tableau.

Textbook 3: Chapter 3,4,5,6,7 and 8

Pre-requisites (Self Learning): Understanding of Visualization techniques.

RBT Levels: L2, L3, L4

IV. COURSE OUTCOMES

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

CO1	Explain the different sources of Data.
CO2	Demonstrate different techniques to Explore Data Analysis and the Data Science Process
CO3	Describe feature selection algorithms & design a recommender system.
CO4	Analyze data visualization tools and libraries and plot graphs.
CO5	Develop charts using Tableau.

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	S4
CO1	3	1		1	2											
CO2	2	2	2		3											
CO3	1	2	2		2								2	1		
CO4		3	2	2	3								1	1		
CO5	2	3	2	2	3								2	2		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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	Edition and Year	Name of the publisher
1	Doing Data Science	Cathy O'Neil and Rachel Schutt	2013	O'Reilly Media
2	Data Visualization workshop	Tim Grobmann and Mario Dobler	-	Packt Publishing
3	Practical Tableau	Ryan Sleeper	1st Edition, 2018	O'Reilly Media

VII(b): Reference Books:

1	Data Science from Scratch	Joel Grus	-	Shroff Publisher
2	A handbook for data driven design	Andy krik	-	-

VII(c): Web links and Video Lectures (e-Resources):
1. https://nptel.ac.in/courses/106/105/106105077/ 2. https://www.oreilly.com/library/view/doing-data-science/9781449363871/toc01.html 3. http://book.visualisingdata.com/ 4. https://matplotlib.org/ 5. https://docs.python.org/3/tutorial/ 6. https://www.tableau.com/
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
Demonstration using projects

Semester:	III	**Course Type:**	ETC		
Course Title: Fundamentals of Artificial Intelligence					
Course Code:	23ISE313		**Credits:**		03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives

1. Identify the problem based on AI.
2. Learn Various AI techniques.
3. Application of AI techniques.
4. Knowledge representation with its forms.
5. Expert system with its diverse aspects.

II. Teaching-Learning Process (General Instructions)

1. Class room lectures
2. Tutorials, which allow for problem-solving exercises and time for students to resolve problems in understanding lecture material.
3. Small periodic assessment, to enable you to assess your understanding of the concepts.
4. Video Lectures

III. COURSE CONTENT

Module-1: Problem Space & Heuristic Search — 8 Hours

Problems on AI, The underlying assumption, AI technique, The level of model, Defining problem as state space, Production system, Issues in the design of search programs, Generate and test ,hill climbing, Best first search, problem reduction, Constraint satisfaction.
Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

Textbook:1,2 Chapter: Chapter 1,Chapter 2,Chapter 3 & Chapter 7 **Sections:** 1.1 to 1.7;2.1 to 2.7;3.1 to 3.6 and 7.1, 7.2, 7.3, 7.4, 7.5

Pre-requisites (Self Learning)

- Knowledge on discrete mathematics.
- Knowledge on algorithms.

RBT Levels: L1,L2

Module-2: Knowledge Representation & its Issues — 8 Hours

Representation and knowledge issue, Approaches to knowledge representation, Representing simple facts in logic, Representing instance and isa relationship, Computable function and predicates, Resolution, Procedural v/s declarative, Forward v/s backward reasoning

Textbook:1 Chapter:4,5,6 **Sections:**4.1 to 4.3;5.1 to 5.4;6.1 to 6.3	
Pre-requisites (Self Learning) • **Knowledge on logic language.**	
RBT Levels: L1,L2	
Module-3: Reasoning	8 Hours
Introduction to non monotonic reasoning, Logics for non monotonic reasoning, Augumenting a problem solver, probability, Baye's theorem, Certainty factor and rule based system, Dempster shafer theory, Fuzzy logic, Semantic nets, frames.	
Textbook:1 **Chapter:**7,8,9 **Sections:**7.1 to 7.4;8.1 to 8.5;9.1 to 9.2	
Pre-requisites (Self Learning) • **Knowledge on discrete mathematics**	
RBT Levels: L1,L2	
Module-4: Logic system and heuristic techniques	8 Hours
Conceptual dependency, Building knowledge base based on conceptual dependency, Scripts, Building knowledge base based on scripts, CYC, The min max search,alpha-beta pruning, Additional refinements, Iterative deepening	
Textbook:1 **Chapter:**10,12 **Sections**10.1 to 10.3;12.1 to 12.5	
Pre-requisites (Self Learning) • **Knowledge on algorithms**	
RBT Levels: L1,L2,L3	
Module-5: NLP and expert systems	8 Hours
Syntactic processing, semantic analysis, Discourse and pragmatic processing, statistical NLP, Rote learning, learning by taking advice, Learning from example, Discovery, Analogy, formal learning theory, Representing and using domain knowledge, Expert system shells, knowledge and acquisition.	
Textbook:1 **Chapter:** 15,17,20 **Sections:**15.1 to 15.5;17.2,17.9;20.1 to 20.4	
Pre-requisites (Self Learning) • **Knowledge on grammar rules.**	
RBT Levels: L1, L2	

IV. COURSE OUTCOMES

CO1	Analyze and identify the problems based on artificial intelligence.
CO2	Interpret the type of problems to choose suitable technique for solution.
CO3	Apply technique in artificial intelligence technique to solve problems.
CO4	Illustrate representation of knowledge in different form.
CO5	Interpret various aspects of expert system

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	S4
CO1	2	2		1									2			
CO2	2	2	1										2			
CO3	2	2	2					1					2			
CO4	2												2			
CO5	2												1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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	Edition and Year	Name of the publisher
1	Artificial Intelligence	Elaine Rich,Kevin Knight and Shivashankar B Nair	3rd edition,2010	McGraw Hill
2	Artificial Intelligence	Stuart J. Russell and Peter Norvig	3rd Edition,2015	Pearson
VII(b): Reference Books:				
1	Artificial Intelligence Structure and strategies for complex	George F Lugar	5th Edition and 2011	----
2	Principles of Artificial Intelligence	Nils J. Nilsson	1st edition	Elsevier

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

Mention the links of the online resources, video materials, etc.
https://onlinecourses.nptel.ac.in/noc21_ge20/preview

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

1. Student Presentation.
2. Referring Research Articles.
3. Exploring Different Project Ideas in the Domain.

Semester:	III	**Course Type:**	ETC		
Course Title: The Fundamentals of Block chain Technology					
Course Code:	23ISE314		**Credits:**		3
Teaching Hours/Week (L: T: P: O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- To familiarize with terminologies of Block chain
- To understand how block chain works
- To impart knowledge in block chain techniques and able to present the concepts clearly and structured.

II. Teaching-Learning Process (General Instructions):

- Assigning assignments and quizzes, and documenting students' progress
- Encourage the students for group learning to improve their creative and analytical skills.
- Show short related video lectures in the following ways:
  - ● As an introduction to new topics (pre-lecture activity).
  - ● As a revision of topics (post-lecture activity).
- Support and guide the students for self–study.

III. COURSE CONTENT

Module-1:	08 Hours

Basics of Blockchain : Introduction, Concepts of Blockchain , Fundamentals of Blockchain , characteristics of Blockchain , consensus in trust-building exercise , public , private and hybrid Blockchain , **Decentralized systems:** distributed ledger technologies , architecture of Blockchain , transactions, chaining blocks

Textbook: Text book -1 , Chapter : Chapter-1 - 1.1 to 1.11, Chapter 2- 2.1 to 2.4

Pre-requisites : Basics of programming skills

RBT Levels: L1,L2 and L3

Module-2:	08 Hours

Hash functions : Introduction , Hashing ,message authentication code , secure hash algorithms(SHA-1) , Secure has algorithm versions-3 , distributed hash tables, hashing and data structures, hashing in Blockchain mining. **Blockchain components:** Ethereum, ethereum virtual machine, ethereum clients, key pairs, languages, development tools , Token Revolution

Textbook: Text book-1 , Chapter: Chapter-3 – 3.1 to 3.8 Chapter-5 : 5.1 to 5.11	
Pre-requisites : Basics of programming	
RBT Levels: L1,L2 and L3	
Module-3:	**08 Hours**
Cryptography: Cryptography, Cryptography primitives, symmetric cryptography, asymmetric cryptography. **Smart Contracts :** Smart contracts , absolute and immutable , contractual confidentiality , law implementation and settlement , characteristics , Internet of things , supply chain management , medical science , finance , Media and entertainment	
Textbook: Text book-1, Chapter: Chapter-6 – 6.1 to 6.5. Chapter-7 : 7.1 to 7.13	
Pre-requisites : Basics of encryption and decryption	
RBT Levels: L1,L2 and L3	
Module-4:	**08 Hours**
Bitcoins: Working of Bitcoins, merkle trees, Bitcoins block structure, Bitcoins address, Bitcoins transactions, Bitcoins network, Bitcoins wallets, payments, Bitcoins clients. **Decentralized applications :** Todays web application requirements , mining in Blockchain Bitcoins , validation and identification , Bitcoins creation , mining hardware , mining software , running miner software , executing several mininers , Bitcoins management , swarm.	
Textbook: Text books-1 , Chapter: Chapter-9 – 9.1 to 9.12	
Pre-requisites : Web Technology Basics	
RBT Levels: L1,L2 and L3	
Module-5:	**08 Hours**
Blockchain vertical solutions and Use Case: Blockchain in insurance, healthcare, assets management, financial institutional assets, smart assets, electronic currency. **Blockchain and allied technologies** : Blockchain and cloud computing , characteristics of Blockchain cloud , Blockchain and artificial intelligence , Blockchain and IoT , Blockchain and machine learning	
Textbook: Text book-1 , Chapter: Chapter – 10 – 10.1 to 10.8 , chapter -11 – 11.1 to 11.5	
Pre-requisites : Basics of programming and web applications	
RBT Levels: L1,L2 and L3	

IV. COURSE OUTCOMES

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

CO1	Describe the basic concepts and technology used for Blockchain.
CO2	Interpret the block chain components
CO3	Describe the primitives of the distributed computing and cryptography related to Blockchain.
CO4	Explain the working of Bitcoins and decentralized applications.

CO5	Analyze to what extent smart and self-executing contracts can benefit automation, governance, transparency and the Internet of Things (IoT);

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	S4
CO1	3	1														
CO2	2	2	1	1									2			
CO3	2	1	1	1	2								2	1		
CO4	2		2		2								2	1		
CO5	2					2						2				

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure Section-1

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	Edition and Year
1	Blockchain Technology : Concepts and Applications	Kumar Saurabh , Ashutosh Saxena	Wiley	1st Edition , 2020
2	The Fundamentals of Blockchain Technology	Saurabh Jain	Notion Press	1st Edition , 2021

VII(b): Reference Books

1	Blockchain developers guide	Brenn Hill , Samanyu Chopra	Packt Publishing Limited	1st Edition , 2022
2	The Basics of Bitcoins Technology	Antony Lewis	Podium Publishing	2nd Edition 2021

VII(c): Web links and Video Lectures (e-Resources): (Insert or delete rows as per requirement)

1. https://www.youtube.com/playlist?list=PLYwpaL_SFmcDFRupamGc-9zc-vQqvkQnn
2. https://www.youtube.com/watch?v=RZFjrI0oWyw&list=PLPIwNooIb9vgfXs-QkRYqqZbDXX-yLf59

VIII: Activity Based Learning

1. One day workshop by industry expert

Semester:	III	**Course Type:**	AEC		
Course Title: Data Science Using Python					
Course Code:	23ISAE31			**Credits:**	1
Teaching Hours/Week (L:T:P:O)			1:0:0:3	**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	2

I. Course Objectives

- Work independently on Data Science(AI and Machine learning) projects
- Data Analysis and Manipulation using Pandas
- Handling Python libraries for data in sights and Visualization
- Understanding different machine learning algorithms(Supervise, Unsupervised and Semi Supervised)
- Understanding the difference between Regression and Classifications
- Text Analysis

II. Teaching -Learning Process(General Instructions):

These are sample Strategies , which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning(PBL),which fosters students' Analytical skills ,develop design Thinking skills such as the ability to design, evaluate, generalize, and analyzed information rather than simply recall it.

III.COURSECONTENT	
III (a). Theory PART	
Module-1: Introduction to Python, data science and to AI-ML and Foundation-Pandas	5 Hours
Python basics, progress to object-oriented programming, and utilize Pandas for CSV handling, data manipulation, statistics, and table operations. They also explore data visualization with libraries like Matplotlib and Seaborn, crucial for presenting insights in Data Science & AI-ML, where they learn statistics, data manipulation, and machine learning implementation using Python libraries.	
Textbook:Textbook1: Chapters: 1 to 9,Chapters 4: Sections 4.1 to 4.5 Chapters 5: Sections 5.2, 5.3	
Pre-requisites (Self Learning) Basic computer literacy and familiarity with mathematics and statistics are beneficial for data science and AI-ML. Understanding Python basics and CSV file structures, along with relational database comprehension, aids in Pandas usage Additionally, basic knowledge of data visualization principles enhances effective graph creation.	
RBTLevels:L1,L2,L3&L4	
Module-2:Foundation-NumpyandFoundation-DescriptiveAnalysis	5 Hours
Understand the distinction between one-dimensional and two-dimensional data structures and how to stack data in a two-dimensional array. Explore techniques for descriptive analysis of single and double numeric variables, along with methods for analyzing both categorical and numeric data types.	
Textbook: Textbook1: Chapters: 4, 5, 10, 11, 12, 14, Chapter 4: Sections 4.1 to 4.5 Chapter 5: Sections 5.2, 5.3	
Pre-requisites (Self Learning) Understanding of Python programming and familiarity with data structures. Additionally, a grasp of fundamental statistical concepts such as mean ,median, and variance is beneficial for descriptive analysis.	
RBTLevels:L1,L2,L3&L4	
Module-3:Regression	5 Hours
Regression basics, data pre processing, and feature selection techniques. Additionally, explore model regularization, residual analysis, and data import methods. Can delve into specific regression implementations, such as linear regression with pre processing, tree-based models, and Cat Boost algorithm with hyper parameter tuning.	
Textbook: Textbook 1: Chapters: 7, 8, 12,·Chapter 7: Sections 7.1 to 7.3 Chapter 8: Sections 8.1 to 8.4	
Pre-requisites (Self Learning): Basic understanding of Python programming, familiarity with data structures, and knowledge of fundamentals statistical concepts. Additionally, comprehension of regression analysis principles and familiarity with machine learning concepts would be beneficial for grasping the topics effectively.	
RBTLevels:L1,L2,L3&L4	
Module-4:Classification	5 Hours
Understand classification algorithms' basics and their practical applications. Hands-on experience in coding Random Forest, Cat Boost, One-Class SVM, and Logistic Regression algorithms for classification tasks. Data loading techniques and gain proficiency in implementing classification algorithm using Python**.**	
Textbook: Textbook 1, Chapters: 7, 8, 13,Chapter 7: Sections 7.1 to 7.3 Chapter 8: Sections 8.1 to 8.4	
Pre requisites (Self Learning) Basic understanding of Python programming and familiarity with fundamental machine learning concepts. Additionally, knowledge of data preprocessing techniques and basic statistics would be beneficial. Understanding the principles of classification algorithms and their applications would also help in comprehending the topics effectively.	
RBTLevels:L1,L2,L3&L4	

Module-5:Advanced Data Clustering and Text Analytics with Python	4 Hours

Delve into clustering algorithms like K Means, Agglomerative, and KNN for grouping data points. Explore text analytics through NLTK installation, tokenization, and Text Blob for tasks like sentiment analysis. Additionally, grasp techniques such as named-entity recognition,stemming, lemmatization, and word cloud generation for comprehensive text analysis.

Textbook: Textbook 1, Chapters: 7, 8, 10, 13,•Chapter 7: Sections 7.1 to 7.3
Chapter 8: Sections 8.1 to 8.4

Pre-requisites (Self Learning) Basic Python proficiency and familiarity with data manipulation are prerequisites. Additionally, understanding fundamental machine learning concepts and basic knowledge of text processing and NLP would be beneficial.

RBTLevels:L1,L2,L3&L4

III(b). PRACTICALPART

Sl. No.	Experiments/Programs/Problems
1	Perform exploratory data analysis on a given data set to summarize its main characteristics
2	Use a data set to create a linear regression model, evaluate its performance using like matrix and Mean Absolute Error (MAE) and R_squared and visualize the regression line.
3	Build a classification model to predict categorical outcomes

IV.COURSE OUTCOMES

CO1	Advance from Python basics to using Pandas, Matplotlib, and Seaborn for data handling and analysis, essential for Data Science &AI-ML
CO2	Understand one vs. two-dimensional data structures and stacking. Explore descriptive analysis techniques for single and double numeric variables and analyze categorical and numeric data types.
CO3	Learn regression basics, pre-processing, and feature selection. Explore regularization, residual analysis, and specific implementations like linear regression, tree-based models, and Cat Boost with tuning.
CO4	Understand classification algorithms, code Random Forest, Cat Boost, One-Class SVM, Logistic Regression, and implement them using Python.
CO5	Learn clustering algorithms (K Means, Agglomerative, KNN) for data grouping and text analytics (NLTK, Text Blob) for sentiment analysis, named-entity recognition, and word cloud generation.

V.CO-PO-PSOMAPPING(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			
CO2	1		2	3									2			
CO3			3		1								2			
CO4		3		1									2			
CO5			2		2								2			

VI. Assessment Details(CIE & SEE)

General Rules: Refer Annexure- Section 5

Continuous Internal Evaluation (CIE): Refer Annexure- Section 5

Semester End Examination: Refer Annexure- Section 5

VII. Learning Resources

VII(a):Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Python for Data Analysis	Wes McKinney	2nd edition2017	O'Reilly Media

VII(b):Reference Books:

1	Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking	Foster Provo stand Tom Fawcett	Second Edition2013	O'Reilly Media
2	Deep Learning	Ian Good fellow, Yoshua Bengio, and Aaron Courville	First Edition2016	The MIT Press
3	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas C	First Edition2016	O'Reilly Media
4	Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems	Aurelien Geron	Second Edition2019	O'Reilly Media

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

- [Kaggle] (https://www.kaggle.com/):Kaggle –Data science competitions, datasets, and tutorials.
- [Python Data Science Handbook] (https://jakevdp.github.io/Python Data Science Handbook/): Python Data Science Handbook-Online resource covering data science using Python.
- [Data Science Full Course - Learn Data Science in 10Hours](https://www.youtube.com/watch?v=_8V5o2UHG0E):Learn Data Science in10Hours-Comprehensive video course covering various data science topics.
- [Python for Data Science Full Course - 6-Hour Python Data ScienceTutorial](https://www.youtube.com/watch?v=rfscVS0vtbw):6-Hour Python Data Science Tutorial-Tutorial covering Python basics, data manipulation, visualization, and machine learning.

VIII:ActivityBasedLearning/PracticalBasedLearning/Experientiallearning:

RBTLevels:L1,L2,L3&L4

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)			0:0:0:2	**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	NA	**Total Marks:**	50
SEE Type:	Theory			**Exam Hours:**	NA

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	5 Hours
Problems on Permutation and Combination. Problems on Surds and Indices **Textbook : Textbook (b) -1: Section –I Page no: 308-373; page no 375-408**	
Prerequisites: Basic knowledge of Mathematics	
Module-2:Visualize Leadership and Negotiation skills	5 Hours

Leadership skills, Persuasion Skills, Negotiation Skills and Conflict Resolving Skills
Textbook: Textbook 5: Chapter-1

Module-3:Quantitative Aptitude – 02	5 Hours

Problems on Percentage, Problems on Profit and Loss , Problems on cubes and Dices.

Textbook : Textbook (b) -1 Section –I Page no: 308-373; page no 375-408

Prerequisites: Basic Calculation Knowledge.

Module-4:Letter and Writing Skills	5 Hours

Writing Skills, Formal, Informal Letters, Sample Letters, Business Professional writings and Adaptability in writing style
Textbook : Textbook 4: Chapter-1

Module-5: Logical Reasoning	4 Hours

Syllogism Concepts and Logical Deduction
Text book : Textbook 3; Chapter1 to 3

Prerequisites: Basic concepts of Set theory/ Venn diagrams

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

CO1	Solve complex problems related to Arithmetic, algebra, geometry, StatisticsPermutation 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.

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		
CO1	2	2						2				1	1			
CO2								2	2			2		2		
CO3	2	2						2				2				
CO4										2		2				
CO5	2	2										1	1	1		

VI. 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

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Fastrack Objective Arithmetic	Rajesh verma	2022	Arihant Publications
2	Algebra Booster	RejaulMarkshud	2017	Mcgraw Hill Education
3	Sense and Syllogism	AparnaTulpule	2019	Whitefalcon
4	A Handbook on letter writing	S.C Gupta	2018	Arihant publications
5	"Leadership Theory and practice"	Peter.GNorthouse	2021	SAGE

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://youtu.be/6B-dvOMTeV8?si=Mx0GqAVqjh6VtDRP
- https://youtu.be/MFj7QIXn-mM?si=AQlxLi086k1GrJuk

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

Assignments, Quizzes and Seminar, group discussions etc.

Semester:	IV	**Course Type:**	BSC		
Course Title: Probability Distributions and Statistical Methods					
Course Code:	**23IST401**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			2:2:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	100	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- 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	8 hours

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.
*** Applications problems to be excluded for SEE**

Textbook1: Chapter 24.4 to 24.6, 24.8 ,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	8 hours

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.
*** Applications 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	8 hours

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.
*** Applications problems to be excluded for SEE.**

Textbook2: Chapter 31.1 ,31.2.

Self Learning: Conditional density function.

RBT Levels: L1, L2 and L3

Module-4: Sampling distributions	8 hours

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 27.1 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	8 hours

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.

*** Applications problems to be excluded for SEE**

Textbook3: Chapter 12.4, 12.5, 12.6.

Self Learning: Analysis of Co-Variance

RBT Levels: L1, L2 and L3

IV. COURSE OUTCOMES

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	Analysethe 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	S4
CO1	3	2	1		1							1				
CO2	3	2	1		1							1				
CO3	3	2	1		1							1				
CO4	3	2	1		1							1				
CO5	3	2	1		1							1				

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure section 1

Continuous Internal Evaluation (CIE)& Rubrics: Refer Annexure section 1

Semester End Examination (SEE)& Rubrics: Refer Annexure section 1

Sl. No.	Title of the Book	Name of the author	Name of the publisher	Edition and Year
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44rd Ed., 2018.
2	Higher Engineering Mathematics	B.V.Ramana	Tata Mc Graw-Hill	11th Ed., 2017
3	Probability & Statistics for Engineers & Scientists	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye	Pearson Education	9th edition, 2017.
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.

Semester:	4	**Course Type:**	PCC		
Course Title: Design and Analysis of Algorithm					
Course Code:	23IST402			**Credits:**	3
Teaching Hours/Week (L: T:P:O)			2:2:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives

- To analyze performance of algorithms.
- To understand and choose the appropriate algorithm design technique for a specified · application.
- To solve problems using algorithm design techniques such as the greedy method, · divide and conquer, dynamic programming, backtracking and branch and bound.
- To analyze the impact of algorithm design techniques on each application solved.
- To introduce and understand P and NP classes

II. Teaching-Learning Process (General Instructions)

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information ratherthan simply recall.

III. COURSE CONTENT

Module-1: Introduction	8 Hours

Introduction: What is an Algorithm, Algorithm Specification - Performance Analysis. Elementary Data Structure: Stacks And Queues- Trees-Dictionaries-Priority Queues- Graphs

Textbook: 1 Chapter: 1,2 sections:1.1 to 1.5, 2.2 to 2.6

Pre-requisites (Self Learning) Basic Knowledge of C and data structures is required

RBT Levels: L1, L2, L3

Module-2: Divide and Conquer	8 Hours
Divide and Conquer: General Method-Binary Search- Finding the Maximum and Minimum, Merge sort, Quick sort - Strassen's Matrix Multiplication, Convex Hull problem.	
Textbook:1 Chapter 3: sections 3.1 to 3.8	
Pre-requisites (Self Learning) Basic Knowledge of C and data structures is required	
RBT Levels: L1, L2, L3	
Module-3: Greedy Method and Dynamic Programming	8 Hours
Greedy Method: General Method-Knapsack Problem-Job Sequencing with Deadlines- Minimum Cost Spanning Tree-Single Source Shortest Path. **Dynamic Programming:** General Method Multistage Graph-All Pairs Shortest Path.	
Textbook:1 Chapter 4,5: Sections: 4.1,4.2,4.4,4.5,4.8,5.1,5.2	
Pre-requisites (Self Learning) Basic Knowledge of C and data structures is required	
RBT Levels: L1, L2, L3	
Module-4: Basic Traversal and Search Techniques and Backtracking	8 Hours
Basic Traversal and Search Techniques: Techniques for Binary Trees –Techniques for Graphs-Connected Components and Spanning Trees-Biconnected Components and DFS. **Backtracking:** General Method-8-Queen Problem, Sum of Subsets Graph Coloring: Hamiltonian Cycle.	
Textbook: Chapter 6: sections: 6.1 to 6.4,7.1 to 7.5	
Pre-requisites (Self Learning) Basic Knowledge of C and data structures is required	
RBT Levels: L1, L2, L3	
Module-5: Branch and bound	8 Hours
Branch and Bound: The Method-0/1 Knapsack Problem. NP-Hard and NP - Complete Problem - Basic Concepts - Cook's Theorem -NP - HARD GRAPH Problems - Clique Decision Problem - Chromatic Number Decision Problem.	
Textbook 1: Chapter 8,11: sections:8.1,8.2,11.1,11.2,11.3	
Pre-requisites (Self Learning) Basic Knowledge of C and data structures is required.	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

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

CO1	Analyze the different algorithm design techniques for a given problem.
CO2	Design algorithms for various computing problems.
CO3	Prove the correctness of algorithms using inductive proofs and invariants.

CO4	Synthesize set operations
CO5	Explain about coping with the limitations of algorithms

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	S4
CO1	1	2											1			
CO2	2	2											1			
CO3		1	2										1			
CO4		2											1			
CO5	2			1						1			1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure –Section 1

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	Edition and Year
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Sartaj Sahni and Rajasekhara N	Universities Press(India) Private Ltd	2018

VII(b): Reference Books:

1	The Design and Analysis of Computer Algorithm	Aho, Hopcroft and Ullman	Pearson Education, Delhi	2001
2	Design Methods and Analysis of Algorithms	Basu S.K	PHI	2006
3	A Design and Analysis of Algorithms	Sandeep Sen and Amit Kumar	Cambridge University Press	2019

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

1. Algorithms and Data Structures Tutorial - Full Course for Beginners (youtube.com)
2. Algorithm Introduction In Computer Science | Design & Analysis of Algorithm (DAA) | Lec-1 (youtube.com)

VIII: Activity Based Learning

Suggested Activities in Class/ Practical Based learning

Assessment Methods

TAPPS- Students working in pairs. One student (the problem solver) is required to read the problem aloud and think aloud during the problem-solving process, which includes verbalizing everything they are thinking and doing. Another student (the listener) attends to the problem

solver's thinking and reminds him/ her to keep saying aloud what he or she is thinking or doing, while also asking for clarifications and pointing out errors being made.

Semester:	IV	**Course Type:**	IPCC		
Course Title: COMPUTER NETWORKS					
Course Code:	23ISI403			**Credits:**	4
Teaching Hours/Week (L: T:P:O)			3:0:2:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives

- Fundamentals of data communication networks.
- Software and hardware interfaces
- Application of various physical components and protocols
- Communication challenges and remedies in the networks.

II. Teaching-Learning Process (General Instructions)

- Assigning assignments and quizzes, and documenting students' progress
- Encourage the students for group learning to improve their creative and analytical skills.
- Classical teaching methods- chalk and talk
- Support and guide the students for self–study.

III. COURSE CONTENT

III(a).Theory PART

Module-1:Introduction Networks	8 Hours

Introduction to networks: Network hardware, Network software, Reference models, Physical Layer: Guided transmission media, Wireless transmission

Textbook 1:Chapter 1.2 to 1.4, Chapter 2.2 to 2.3

Pre-requisites (Self Learning): Communication Satellites, Digital Modulation and Multiplexing.

RBT Levels:L1, L2

Module-2:Data Link layer	8 Hours

The Data link layer: Design issues of DLL, Error detection and correction, Elementary data link protocols, Sliding window protocols. The medium access control sublayer: The channel allocation problem, Multiple access protocols.

Textbook 1: Ch.3.1 to 3.4, Ch.4.1 and 4.2

Pre-requisites (Self Learning): Ethernet, Classic Ethernet Physical layer, MAC sublayer protocol, Performance.

RBT Levels: L1, L2

Module-3: Network layer	8 Hours
The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, QoS.	
Textbook 1: Ch 5.1 to 5.4	
Pre-requisites (Self Learning): Internetworking, Internetworking routing, packet fragmentation, IPv4, IPv6.	
RBT Levels:L1, L2, L3	
Module-4: Transport Layer	8Hours
The Transport Layer: The Transport Service, Elements of transport protocols, Congestion control, The internet transport protocols:UDP and TCP	
Textbook 1: Ch 6.1 to 6.4 and 6.5.1 to 6.5.7	
Pre-requisites (Self Learning):TCP Sliding Window, TCP Timer Management, TCP Congestion Control.	
RBT Levels: L1, L2, L3	
Module-5:Application Layer	8 Hours
Application Layer: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet.	
Textbook 2: Ch 2.1 to 2.4	
Pre-requisites (Self Learning):DNS-The Internet's Directory Service, Peer to Peer Applications, Socket Programming: Creating Network Applications.	
RBT Levels:L1, L2, L3	

III(b). PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1	Implement Three nodes point – to – point network with duplex links between them for different topologies. 1Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations..
2	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4	Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
5	Write a program for error detecting code using CRC-CCITT (16- bits).
6	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
7	Write a HTTP web client program to download a web page using TCP sockets
8	Implement the Simulation of Distance Vector/ Link State Routing algorithm

IV. COURSE OUTCOMES

CO1	Classify the basic needs of communication architectures
CO2	Explain the various protocols and solution in the network stack
CO3	Apply the algorithms at the appropriate layer for any communication network task
CO4	Develop the solutions to various problems in network theory
CO5	Explain network service quality and applications of various layers.

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
CO 1	3												2	
CO 2	3				2								2	
CO 3	3	2			3							3	2	
CO 4	3	2	3	2	3							3	2	
CO 5	3	2	3	2	3							3	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer annexure- Section 2

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	Edition and Year	Name of the publisher
1	Computer-Networks	Behrouz A. ForouzaAndrew S. Tanenbaum and David J. Wetherall n	5th Edition.	Pearson Education
2	Computer Networking, A Top-Down Approach	James F Kurose and Keith W Ross	6thEdition .2017	Pearson

VII(b): Reference Books:

1	Data and Communications and Networking	Behrouz A Forouzan	fifth edition	McGraw Hill, Indian Edition
2	Computer Networks	Larry L Peterson n and Brusce S Davie	fifth edition	ELSEVIER

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

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. http://www.digimat.in/nptel/courses/video/106105081/L25.html
3. https://nptel.ac.in/courses/106105081

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

1. Activity based learning
2. Project based learning

Semester:	4	**Course Type:**	IPCC		
Course Title: Operating System					
Course Code:	23ISI404			**Credits:**	4
Teaching Hours/Week (L:T:P:O)			3:0:2:0	**Total Hours:**	05
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different resources
- To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

II. Teaching Learning Process (General Instructions)

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

- Lecturer methods (L) need not to be only traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop designthinking skills such as the ability to design, evaluate, generalize, and analyze information ratherthan simply recall it.
- Role play for process scheduling.
- Demonstrate the installation of any one Linux OS on VMware/Virtual Box

III(a). COURSE CONTENT

Module-1: Introduction to operating systems — 8 Hours

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;

Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.9)

Pre-requisites (Self Learning)
Understanding of computer architecture, knowledge of operating system principles and concepts is required.

RBT Levels: L1, L2	
Module-2: Process Management	8 Hours
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)	
Pre-requisites (Self Learning) Basic Knowledge of hardware system components is required and Skills such as proficiency in programming languages (e.g., C, C++) required for lab programs	
RBT Levels:L1,L2,L3	
Module-3: Process Synchronization	8 Hours
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)	
Pre-requisites (Self Learning) Students should have Problem-solving abilities, and they must familiarity with networking concepts.	
RBT Levels: L1,L2,L3	
Module-4: Memory Management	8 Hours
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)	
Pre-requisites (Self Learning) Basic Knowledge of hardware system components is required.	
RBT Levels: L1,L2,L3	
Module-5: File System	8 Hours
File System: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; **Implementing File system:** File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **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.	
Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.3)	

Pre-requisites (Self Learning)

Security concepts are crucial for a career in operating systems.

RBT Levels: L1,L2,L3

III(b). Practical Part

1. Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)
2. Simulate the following CPU scheduling algorithms to find turnaround time and waiting time

   a) FCFS b) SJF c) Round Robin d) Priority.
3. Develop a C program to simulate producer-consumer problem using semaphores.
4. Develop a C program which demonstrates inter process communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5. Develop a C program to simulate Bankers Algorithm for Deadlock Avoidance.
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 page replacement algorithms:

   a) FIFO b) LRU
8. Simulate following File Organization Techniques

   a) Single level directory b) Two level directory
9. Develop a C program to simulate the Linked file allocation and Index file allocation strategies.
10. Develop a C program to simulate FCFS, SSTF, SCAN disk scheduling algorithm.

III. COURSE OUTCOMES

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

CO 1	Describe the structure and functionality of operating system.
CO 2	Apply appropriate CPU scheduling algorithms for the given problem.
CO 3	Analyze the various techniques for process synchronization and deadlock handling.
CO 4	Explore the various techniques for memory management.
CO 5	Learn strategies for managing files and secondary storage.

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	1	2											1			
CO2	2	2											1			
CO3		1	2										1			
CO4		2											1			
CO5	2			1						1			1			

V. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 2

Continuous Internal Evaluation (CIE): Refer Annexure- Section 2

Semester End Examination (SEE): Refer Annexure- Section 2

VI. Learning Resources

VII(a): Textbooks:

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

VII(b): Reference Books:

1	Understanding Operating System, Cengage Learning,	Ann McHoes Ida M Fylnn		6th Edition
2	Operating Systems: A Concept Based Approach	D.M Dhamdhere	McGraw- Hill	3rd Ed, 2013
3	An Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	PHI(EEE)	4th Edition, 2014
4	Operating Systems: Internals and Design Principles	William Stallings	Pearson	6th Edition

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

1. https://youtu.be/mXw9ruZaxzQ
2. https://youtu.be/vBURTt97EkA
3. https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0 YE_f
4. https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPns WzkeRn6mkO
5. https://www.os-book.com/OS9/slide-dir/index.html

VIII: Activity Based Learning

Suggested Activities in Class/ Practical Based learning

- Assessment Methods
  - Case Study on Unix Based Systems
  - Lab Assessment

Semester:	IV	**Course Type:**	PCCL		
Course Title: DAA Lab with JAVA					
Course Code:	23ISL405			**Credits:**	1
Teaching Hours/Week(L:T:P:O)			0:0:2:0	**Total Hours:**	Lab Slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	3

I. Course Objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Dynamic memory management.
- Linear data structures and their applications such as stacks, queues and lists.
- Non-Linear data structures and their applications such as trees and graphs.

II. Teaching-Learning Process (General Instructions)

- Implement all the programs in JAVA Programming Language and Linux OS.
- Experiential Learning
- PBL an ABL
- Video lectures/animations
- Traditional Teaching methods

III. PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1.	Implement and calculate the time complexity and space complexity of following program s i)Fibonacci Series ii) Factorial of a Number
2.	Implement Recursive Binary search and Linear search and determine the time required to search an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n. Implement Recursive Binary search and Linear search and determine the time required to search an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken

3.	Sort a given set of elements using the Merge sort method and determine the time requied to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4.	Obtain the Topological ordering of vertices in a given graph.
5.	Implement 0/1 Knapsack problem using dynamic programming.
6.	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
7.	Sort a given set of elements using the Quick sort method and determine the time requied to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
8.	Design and develop a program in C that uses Hash Function H:K->LasH(K)=K Mod m(reminder method)and implement hashing technique to map a given key Kto the address space L. Resolve the collision(if any) using linear probing.
9.	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
10.	Find a subset of a given set S={s1,s2,….sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S={1,2,5,6,8} and d=9 there are two solutions {1,2,6} and {1,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.

PART- B

A team of two students will develop a prototype using the Java language to demonstrate the use of Algorithms in real-time applications. For example, they used various sorting methods to sort results, graphs to navigate places, graphs for recommendations and match-making, BFS for social networking sites , and Topological ordering to generate dependency graph. Their innovative applications of data structures attracted high marks.
(Ref: Algorithm Definition, Properties and Real-life Applications (enjoyalgorithms.com)/).

II.COURSEOUTCOMES

CO1	Design algorithms using divide and conquer, greedy and dynamic programming
CO2	Execute sorting algorithms such as sorting, graph related and combinatorial algorithm in a high level language.
CO3	Analyze the performance of merge sort and quick sort algorithms using divide and conquer technique
CO4	Apply the dynamic programming technique to solve real world problems such as knapsack and TSP

III.CO-PO-PSOMAPPING (Mark H=3;M=2;L=1)

PO/PSO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**S1**	**S2**		
CO1	2	2	2	2	1							1		3		
CO2	1	-	-	2	1							1		1		

CO3	2	2	2	2	1							1		3		
CO4	2	2	2	2	1							1		3		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure - Section 4

Continuous Internal Evaluation (CIE): Refer Annexure - Section 4

Semester End Examination (SEE): Refer Annexure - Section 4

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

1.GitHub - sam-trg/daa-lab: Lab programs, spreadsheets, and graphs for Design and Analysis of Algorithms (DAA) Lab

2. Design and Analysis of Alogorithm (searchcreators.org)

VII(b): Activity Based Learning

Project based learning: Students can be asked to form project teams with 2 members. Restrictions can be posted to each group such that each team must comprise of good, average and poor learners.

Flipped Classroom (FC) and Think Pair Share (TPS) activity : Different problem on the topic has to be given to the students. Each student has to think about the solution for 2-3 minutes, then the solution has to be discussed with their peer/pair for 4-5 minutes and the solution has to be shared and discussed among all the students by any one group or by the faculty him/herself.

Semester:	IV	**Course Type:**	ETC		
Course Title: Cyber Security and Cyber laws					
Course Code:	23ISE421			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- Define cyber security, cyber law and their roles
- Demonstrate cyber security cybercrime and forensics.
- Infer legal issues in cybercrime,
- Demonstrate tools and methods used in cybercrime and security.
- Illustrate evidence collection and legal challenges

II. Teaching-Learning Process (General Instructions)

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

- Lecturer methods (L) need not be only traditional lecture method, but alternative
- Effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it

III. COURSE CONTENT

Module-1:Introduction to Cybercrime	8 Hours

Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals, Classifications of Cybercrimes, Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafé and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

Textbook1: Chapter: sections: chapter1(1.1 to 1.5), chapter2(2.1 to 2.8)

Pre-requisites (Self Learning) basic knowledge of computer networks and operating systems

RBT Levels: L3

Module-2: Cybercrime	8 Hours
Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices ,Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	
Textbook1: Chapter3: sections (3.1-3.12)	
Pre-requisites (Self Learning) basic knowledge of computer networks, operating systems and programming skils	
RBT Levels:L3	
Module-3: Tools and Methods Used in Cybercrime	8 Hours
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks,SQL Injection, Buffer Overflow, Attacks on Wireless Networks.	
Textbook1: Chapter 4: Sections:(4.1 to 4.12)	
Pre-requisites (Self Learning) basic knowledge of computer networks and cybercrime	
RBT Levels: L3	
Module-4: Computer Forensics	8 Hours
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography , Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites	
Textbook1: Chapter7: sections (7.1 to 7.14)	
Pre-requisites (Self Learning) basic knowledge of Cyber attacks	
RBT Levels:L3	
Module-5:Information Technology Act	8 Hours
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations Appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions	
Textbook2: Chapter 20	
Pre-requisites (Self Learning) knowledge on cyber-attacks and cyber security	
RBT Levels: L2	

IV. COURSE OUTCOMES

At the end of course student will be able to

CO1	Explain cybersecurity, cybercrime and forensics
CO2	Analyze Cybercrime frauds and attacks in mobile and wireless devices
CO3	Demonstrate and Analyze tools and methods used in cybercrime and security

CO4	Illustrate evidence collection and legal challenges

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	S4
CO1	2		1										2			
CO2		2	1										2			
CO3		1			2								2			
CO4	1	1											2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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	Edition and Year
1	Cyber Security	SunitBelapure and NinaGodbole	Wiley India Pvt Ltd..	2013
2	Cyber security and Cyber Laws	Alfred Basta ,Nadine Basta ,Mary Brown and Ravinder Kumar	Cengage	2018

VII(b): Reference Books:

1	Cybersecurity	Thomas J. Mowbray.	John Wiley & Sons	
2	Cyber Security Essentials	James Graham, Ryan Olson, Rick Howard.	CRC Press	2010

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

1. https://www.udemy.com/course/cybersecurity-law-policy/
2. https://www.youtube.com/watch?v=BS5v5Rr-oVo&list=PL-JvKqQx2AteIbm-z4X709scVr9OaHpIY

VIII: Activity Based Learning

The students, with the help of the course teacher, can take up relevant technical activities which will enhance their skill.

Semester:	4	**Course Type:**	ETC		
Course Title: Business Intelligence and applications					
Course Code:	23ISE422			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	50
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- Explain the Business Intelligence, Analytics and Decision Support system
- List the technologies for Decision making, Automated decision systems
- Explain sentiment analysis techniques
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

II. Teaching-Learning Process (General Instructions)

- Assigning assignments and quizzes, and documenting students' progress
- Encourage the students for group learning to improve their creative and analytical skills.
- Classical teaching methods- chalk and talk
- Support and guide the students for self–study.

III. COURSE CONTENT

Module-1: An Overview of Business Intelligence, Analytics, and Decision Support	8 Hours

Introduction to information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics

Textbook:1 Chapter:1 sections:1.4-1.9

Pre-requisites : Student must have basic knowledge about computers and excel.

RBT Levels: L2

Module-2: Decision Making	8 Hours

Introduction and Definitions, Phases of the Decision Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Component

Textbook:1 Chapter:2 sections: 2.2- 2.11

Pre-requisites : Student must have basic knowledge about information systems.

RBT Levels: L2

Module-3: Neural Networks and Sentiment Analysis	8 Hours

Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.

Textbook:1 Chapter:6, 7 sections: 6.2 - 6.7, 7.7-7.10

Pre-requisites : Student must have basic knowledge about algorithms.

RBT Levels: L3

Module-4: Model-Based Decision Making	8 Hours

Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.

Textbook:1 Chapter:9 sections: 9.2-9.9

Pre-requisites : Student must have basic knowledge about excel.

RBT Levels: L3

Module-5: Automated Decision Systems and Expert Systems	8 Hours

Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Textbook:1 Chapter:11 sections : 11.2-11.9

Pre-requisites : Student must have basic knowledge about information systems.

RBT Levels: L3

IV. COURSE OUTCOMES

CO1	Describe business intelligence, analytics and decision support
CO2	Explain the technologies for decision making
CO3	Apply predictive modelling techniques(can be attained through assignment or CIE)
CO4	Apply sentiment analysis techniques(can be attained through assignment or CIE)

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	S4
CO1	3															
CO2	3															
CO3		2	3										3			
CO4		3		2	3								2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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**	**Edition and Year**	**Name of the publisher**
1	Business Intelligence and Analytics: System for Decision Support	. Ramesh Sharda, DursunDelen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King,	10th Edition, 2013	Pearson Global Edition
VII(b): Reference Books:				
1	Data Analytics: The Ultimate Beginner's Guide to Data Analytics	Edward Mize	12 November 2017	CreateSpace Independent Publishing Platform
VII(c): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=zbcCdoHeS4w				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
1. Activity based learning **2.** Project based learning				

Semester:	IV	**Course Type:**	ETC		
Course Title: Fuzzy Logic and Neural Networks					
Course Code:	23ISE423			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives

- To understand the basic concept of fuzzy sets, fuzzy logic & defuzzification
- To learn the basics of Artificial Neural of theory and programming of Microprocessors
- To analyze various techniques in feedback and feed-forward Neural networks.
- To Understand the principle of competitive neural networks and Adaptive resonance theory.
- To learn the architecture and algorithm of Cognition, Neo cognition, the concepts of fuzzy associative memory and fuzzy systems.

II. Teaching-Learning Process (General Instructions)

- Class room lectures
- Tutorials, which allow for problem-solving exercises and time for students to resolve problems in understanding lecture material.
- Small periodic assessment, to enable you to assess your understanding of the concepts.
- Video Lectures

III. COURSE CONTENT

Module-1: FUNDAMENTALS OF FUZZY LOGIC — 8 Hours

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets, characteristics and significance of paradigm shift, types of operations, fuzzy complements, fuzzy intersections: t-Norms, Fuzzy unions, combinations of operations, aggregation operations.

Textbook: 1: Chapter: 1,3: Sections:1.1 to 1.5;3.1 to 3.6

Pre-requisites (Self Learning): Knowledge on discrete mathematics.

RBT Levels: L1, L2	
Module-2: ARCHITECTURE OF NEURAL NETWORKS	8 Hours
Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functions basic learning rules- Mcculloch-Pitts neuron- Architecture, algorithm, applications.	
Textbook:2: Chapter:1: Sections:1.1 to 1.6	
Pre-requisites (Self Learning) • Knowledge on artificial neurons and its design principles. • Knowledge on pattern recognition concepts.	
RBT Levels: L1, L2	
Module-3: BASIC NEURAL NETWORK TECHNIQUES	8 Hours
Biases and threshold, linear separability, data representation, Hebb Net algorithm, and its application, Perceptron: architecture, algorithm, application, perceptron learning convergence theorem, Adaline: architecture, algorithm, applications, derivations, madaline.	
Textbook:2: Chapter: 2:Sections:2.1 to 2.5	
Pre-requisites (Self Learning) • Knowledge on different neural network training rules.	
RBT Levels: L1, L2	
Module-4: BACKPROPAGATION NEURAL NET	8 Hours
Standard Back propagation: architecture, algorithm, applications, Variations: Alternate weight update procedures, alternative activation functions, strictly local backpropagation, number of hidden layers.	
Textbook:2: Chapter:6: Sections:6.1 to 6.3	
Pre-requisites (Self Learning) • Knowledge on neural network training process.	
RBT Levels: L1 ,L2	
Module-5: Adaptive Resonance Theory and SPECIAL NEURAL NETWORKS	8 Hours
Introduction to ART: ART 1, ART 2, fixed weights for constrained optimization: Boltzmann machine, continuous Hopfield net, gaussian machine, Cauchy machine, simple recurrent net, backpropagation training for fully recurrent nets, probabilistic neural net.	
Textbook:2:Chapter:5.7: Sections:5.1 to 5.3,7.1 to 7.3	
Pre-requisites (Self Learning) • Knowledge on abstract design of neural networks.	
RBT Levels: L1,L2,L3	
IV. COURSE OUTCOMES	

CO1	Explain And Apply The Basic Concepts Of Fuzzy Sets, Fuzzy Logic, And Defuzzification.
CO2	Distinguish Between The Fundamentals Of Artificial Neural Networks And The Programming Principles Of Microprocessors.
CO3	Compare And Contrast Various Techniques Used In Feedback And Feed-Forward Neural Networks.
CO4	Analyze And Evaluate The Principles Of Competitive Neural Networks And Adaptive Resonance Theory.
CO5	Describe And Differentiate Between The Architectures And Algorithms Of Cognitive Networks, Neocognitron, Fuzzy Associative Memory, And Fuzzy Systems.

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	S4
CO1	3	3											2			
CO2		2											2			
CO3	2												1			
CO4	2	2											2			
CO5	2	2	1										1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 1

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	Edition and Year
1	Fuzzy System & Fuzzy logic	George J. Klir / Bo Yuan	pearson	First Edition. 2015
2	fundamental of Neural network	Lawrence Fussett	pearson	First Edition 2004

VII(b): Reference Books:

1	Neural network and Fuzzy System	Bart Kosko	Prentice Hall	First Edition 1994
2	Fuzzy sets	J.Klin and T.A.F J.Klin and T.A.Folger olger	Prentice Hall	Second Edition 1996
3	Introduction to artificial neural systems	J.M.Zurada	Jaico Publication House	First Edition 1994
4	C++ Neural network and fuzzy logic	VallusuRao and HayagvnaRao	BPB and Publication	Second Edition 1996

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

1. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

VIII: Activity Based Learning

1. Student Presentation.
2. Referring Research Articles.

3. Exploring Different Project Ideas in the Domain.

Semester:	IV	**Course Type:**	ETC		
Course Title: Blockchain for Business					
Course Code:	23ISE424			**Credits:**	03
Teaching Hours/Week (L: T: P: O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- To understand the purpose of Blockchain in the field of various business domains.
- To learn how to develop transactions in business.

II. Teaching-Learning Process (General Instructions):

- Assigning assignments and quizzes, and documenting students' progress
- Encourage the students for group learning to improve their creative and analytical skills.
- Show short related video lectures in the following ways:
- As an introduction to new topics (pre-lecture activity).
- As a revision of topics (post-lecture activity).
- Support and guide the students for self–study.

III. COURSE CONTENT

Module-1: Introduction to Blockchain	08 Hours

Blockchain Beliefs, Enterprise Blockchain , Why Blockchain Matters, Motivation: Driving Momentum within the Ecosystem , Blockchain for Good , **Opportunities and Challenges :** Disruptive Elements , Transformative Power of Blockchain, Distributed Organizational Structure , Decentralized Ecosystem , Transformative Opportunities , Challenges

Textbook: Text book -1 **, Chapter:** Chapter 1 & Chapter-2

Pre-requisites : Fundamentals of blockchain

RBT Levels: L1,L2 and L3

Module-2: Understanding the Technology Landscape	08 Hours

Blockchain: A Technical Perspective , The Four Building Blocks , Blockchain as a Consumable Technology , Blockchain for Enterprises , Enterprise View of Blockchain: Technology and Business Domain , types of Blockchain, Technology, Business, and Regulatory Considerations for Blockchain , Essential Maturity Imperatives for Enterprise Blockchain , Introduction to Tokenization: Understanding the Token Revolution

Textbook: Text Book – 1 , Chapter: Chapter-3

Pre-requisites : Basics of Blockchain technology

RBT Levels: L1,L2 and L3

Module-3: Business of Business Models	**08 Hours**

Path to Blockchain Enterprise Adoption: A Prescriptive Approach , Business Modeling and Design , Business Model Considerations , Business Ecosystem , Build–Own–Operate or Founder-Led Networks , Build–Own–Operate–Transfer or Founding Consortium–Led Network .**Developing a Governance Structure for Blockchain Networks :** Governance Structure and Landscape , Technology Infrastructure Governance , Network Membership Governance , Business Network Governance , SCTrustNet , Business Network Governance

Textbook: Text book-1 Chapter: Chapter-4 & Chapter-5

Pre-requisites : Basics of Networking

RBT Levels: L1,L2 and L3

Module-4: Building Teams & Frameworks	**08 Hours**

Building a Team to Drive Blockchain Projects: Enterprise Structures in a Decentralized Economy, Roles of an Enterprise in a Blockchain Network, Building an Effective Team, Intraprise Synergy, An Example of a Blockchain Project Team. **Understanding Financial Models, Investment Rubrics, and Model Risk Frameworks:** Understanding Blockchain Project Financial Fundamentals, Blockchain Investment Rubric, Return on Investment Modeling, Blockchain Model Risk Framework, Devising a Business and Technology Blueprint.

Textbook: Text Book-1 Chapter: Chapter- 6 & Chapter-7

Pre-requisites : Fundamentals of blockchain

RBT Levels: L1,L2 and L3

Module-5: Futures of Blockchain	**08 Hours**

Looking Ahead-What Does the Future Hold: The Network of Networks, Blockchain at the Nexus of Technology, Blockchain and IoT, Blockchain and Quantum Computing, Blockchain Opportunities and Challenges, Case studies.

Textbook: Text book-1, Chapter: Chapter-8

Pre-requisites : Basics of networking

RBT Levels: L1,L2 and L3

IV. COURSE OUTCOMES

CO1	Describe the basic technology used for Blockchain and challenges faced.
CO2	Develop the technological landscape and building blocks of Blockchain
CO3	Illustrate the business models and governance structure of Blockchain
CO4	Apply knowledge for building projects in Blockchain and developing frameworks
CO5	Analyze the future of Blockchain with existing technology and opportunities

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	S4
CO1	2	1														
CO2	2	1	1	1									2			
CO3	2	1	1	1	2								1	1		
CO4	1		2		2								1	1		
CO5	2					2						1				

VI. Assessment Details (CIE & SEE)

General Rules: Refer annexure- Section 1

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	Edition and Year
1	Blockchain for Business	Jai Singh Arun, Jerry Cuomo, Nitin Gaur	Addison-Wesley Professional	1st Edition , 2019
2	The Fundamentals of Blockchain Technology	Saurabh Jain	Notion Press	1st Edition , 2021

VII(b): Reference Books

1	Blockchain developers guide	Brenn Hill , Samanyu Chopra	Packt Publishing Limited	1st Edition , 2022
2	The Basics of Bitcoins Technology	Antony Lewis	Podium Publishing	2nd Edition 2021

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

- https://www.youtube.com/playlist?list=PLYwpaL_SFmcDFRupamGc-9zc-vQqvkQnn
- https://www.youtube.com/watch?v=RZFjrI0oWyw&list=PLPIwNooIb9vgfXs-QkRYqqZbDXX-yLf59

VIII: Activity Based Learning

1. One day workshop by industry expert

Department of Information Science and Engineering

Semester:	IV	**Course Type:**	AEC		
Course Title: JAVA PROGRAMMING					
Course Code:	23ISAE41			**Credits:**	1
Teaching Hours/Week (L:T:P:O)			1:0:0:3	**Total Hours:**	24 hours + other pedagogy
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	2

I. Course Objectives

- Understand the structure and use of the main method in a Java application.
- Declare primitive variables, manipulate strings, handle arrays and array lists, and perform type conversions.
- Implement branching and looping statements for flow control.
- Construct class definitions, declare and access data members, and understand object-oriented concepts.
- Implement methods, instantiate objects, and apply access modifiers and method overloading.

II. Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

- Chalk and board, power point presentations
- Online material (Tutorials) and video lectures.
- Demonstration of programming examples.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Java Fundamentals — 5 Hours

Describe the use of main in a Java application, perform basic input and output using standard packages,Evaluate the scope of a variable,Comment and document programs.

Textbook:1 Chapter 2: An Overview of Java, Sections: 2.3-2.6

Pre-requisites (Self Learning)

Basic understanding of what programming is and familiarity with concepts like algorithms and flowcharts. Basic knowledge of at least one other programming language (optional but helpful).

RBT Levels: L1 & L2	
Module-2: Data Types, Variables, and Expressions	5 Hours
Declare and use primitive data type variables, Construct and evaluate code that manipulates strings, Construct and evaluate code that creates, iterates, and manipulates arrays and array lists,Construct and evaluate code that performs parsing, casting, and conversion, Construct and evaluate arithmetic expressions	
Textbook: Chapter 3: Data Types, Variables, and Arrays, Sections: 3.1-3.5	
Pre-requisites (Self Learning) Basic arithmetic operations (addition, subtraction, multiplication, division).Understanding of mathematical expressions and operator precedence.	
RBT Levels: L5 &L6	
Module-3: Flow Control Implementation	5 Hours
Construct and evaluate code that uses branching statements, Construct and evaluate code that uses loops.	
Textbook:1 Chapter 5: Control Statements, Sections: 5.4-5.6	
Pre-requisites Basic knowledge of logical operators and constructs. Ability to trace and understand simple flowcharts and pseudocode.	
RBT Levels: L5 &L6	
Module-4: Object-Oriented Programming	5 Hours
Heading: Construct and evaluate class definitions, Declare, implement, and access data members in classes, Implement code on OOPs (Encapsulation, Inheritance, Polymorphism, Abstraction, Interface)	
Textbook: 1 Chapter 6: Introducing Classes, Sections: 6.1-6.4	
Pre-requisites Understanding the concepts of classes and objects. Familiarity with terms like inheritance, polymorphism, and encapsulation (basic level).	
RBT Levels: L5 &L6	
Module-5: Exception Handling	4 Hours
Declare, implement, and access methods, Instantiate and use class objects in programs Troubleshoot syntax errors, logic errors, and runtime errors, Implement exception handling	
Textbook:1 Chapter 6: Introducing Classes, Sections: 6.8-6.10	
Pre-requisites (Self Learning) Understanding of method overloading and overriding. Familiarity with the concept of constructors and destructors in any programming language.	
RBT Levels: L1 &L2	

III(b). PRACTICAL PART	
Sl. No.	**Experiments / Programs / Problems**
1	Develop a Java program to sort the elements in ascending and descending order.

2	Develop a Java program to demonstrate function overloading for the following prototypes. Add (int a, int b) add (double a, double b)
3	Develop a Java program using Operator Overloading for overloading Unary minus operator.
4	Develop a Java program to implement Multiple inheritance for performing arithmetic operation of two numbers
5	Develop a Java program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
6	Write a Java program to derive a class publicly from base class. Declare base class members under public, private and protected
7	Develop a Java program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
8	Create a Java project using OOPS (Ex. ATM machine, Student Management System, Hospital Management System)

IV. COURSE OUTCOMES

CO1	Proficiently write and execute Java programs with proper structure and documentation.
CO2	Effectively perform data manipulation and conversion using primitive types, strings, arrays, and array lists.
CO3	Utilize control flow statements to create logical and efficient program execution.
CO4	Design and implement classes with appropriate data members and methods, applying object-oriented principles.
CO5	Debug, troubleshoot, and handle exceptions to maintain robust and error-free code.
CO6	Develop comprehensive Java applications that integrate all learned concepts and techniques.

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	S4
CO1	2												2			
CO2		2											2			
CO3			2										2			
CO4			2										2			
CO5				2									2			
CO6				2									2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer Annexure- Section 5

Continuous Internal Evaluation (CIE): Refer Annexure- Section 5

Semester End Examination (SEE): Refer Annexure- Section 5

VII. 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"	11th Edition, 2018	11th Edition, 2018	McGraw-Hill Education

2	"Headfirst Java"	Kathy Sierra, Bert Bates	2nd Edition, 2005	O'Reilly Media
3	"Effective Java"	Joshua Bloch	3rd Edition, 2018	Addison-Wesley Professional
VII(b): Reference Books:				
1	Effective Java	Joshua Bloch	2018	Addison-Wesley Professional
2	Java: The Complete Reference	Herbert Schildt	**2018**	McGraw-Hill Education
VII(c): Web links and Video Lectures (e-Resources):				
1. Resource Type: Online Tutorial Link or Title: https://www.w3schools.com/java/default.asp 2.Resource Type: Video Lectures Link or Title: Oracle's Java Tutorials Description: Official YouTube channel for Java tutorials by Oracle				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Mention suggested Activities like seminar, assignments, quiz, case studies, mini projects, industry visit, self-study activities, group discussions, etc.				

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)			0:0:0:2	**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	NA	**Total Marks:**	50
SEE Type:	Theory			**Exam Hours:**	02

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	5 Hours
Problems on Pipes Cisterns , Time , Work and Averages **Textbook: Textbook 1; Section-1;Page no-510to525**	
Prerequisites: Have the basic knowledge of Mathematics and logics	

Module-2:Time management and Presentation skills	5 Hours
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 **Textbook : Textbook 2; Chapter-2**	
Prerequisites: (Self learning): Basic Presentation ideas and Time management.	
Module-3:Quantitative section and Data Interpretation	5 Hours
Simple interest and compound interest problems, Bar graphs, Pie charts and Line graphs concepts and problem. **Textbook: Textbook 1;Section-I; Page no 641-687**	
Prerequisites: Basic Calculation knowledge.	
Module-4:Body language and Postures	5 Hours
Facial expressions, Gestures, Handshakes, tone of voice, Attitude, Universal vs. Culture specific. **Textbook: Textbook 3**	
Module-5: Mental ability	4 Hours
Puzzle based question and Psychometric based interview Question **Reference link: https://www.hitbullseye.com/puzzle/logical-puzzle-questions-with-answers.php**	
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		
CO1		3		3				2				1	2			
CO2								2	2			2		2		
CO3	3	2						2	2		2	2	2			
CO4						2		2		2		2		2		
CO5	2	2	3									3	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-1section 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	Quantitative Aptitude for Competitive examination	R S Agarwal	2017	S Chand
2	Time Management	Marc Mincini	2003	Mcgraw Hill
3	Gestures and Body Language	Aparnamajumdar	2017	V& S Publisher
VII(b): Reference Books:				
1	Gestures and Body Language	Aparnamajumdar	2017	V& S Publisher

2	A modern approach to logical reasoning	R S Agarwal	2019	S Chand

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

- https://youtu.be/-iQEzSd9QUQ?si=qwWVOnDiky3vyuju
- https://youtu.be/MV00SQU_f7E?si=Rq0EAIZKzCU-EVOp
- https://youtu.be/MV00SQU_f7E?list=PLOoogDtEDyvvDNHO_Ba58OrE567nCzzl2

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)

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)

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)
				I. Theory Component							II. Practical Component											Theory				Practical				
		Total CIE marks	Min. Eligty.	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)	Total CIE marks	Dur. In hrs.	Max. cond. marks	Max. considered marks	min. pass %	Max. cond. marks	Max. considered marks	min. pass %	Total SEE marks	
						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

|| 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 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.

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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.

|| Jain Sri Gurudev ||

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