GOVERNMENT OF INDIA
MINISTRY OF
PARLIAMENTARY AFFAIRS

PREAMBLE TO THE CONSTITUTION

PREAMBLE

WE, THE PEOPLE OF INDIA.

having solemnly resolved to constitute India
into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC
REPUBLIC and to secure to all its citizens:
JUSTICE, social, economic and political;
LIBERTY of thought, expression, belief, faith and worship:
EQUALITY of status and of opportunity;
and to promote among them all
FRATERNITY assuring the dignity of the individual and
the unity and integrity of the Nation;
IN OUR CONSTITUENT ASSEMBLY this 26th day of
November, 1949, do HEREBY ADOPT, ENACT AND GIVE
TO OURSELVES THIS CONSTITUTION.

I have read the Preamble

Signature

23-01-2026

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

("Deemed to be University u/s 3 of the UGC Act, 1956")
Accredited 'A+' Grade by NAAC(2nd Cycle)
Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

No. SSAHE/ACA-S&C/114/UG (BE)/2026 **Date: 23/09/2026**

NOTIFICATION

Sub:- Ordinance pertaining to Curriculum of Undergraduate Programme in Bachelor Engineering (2nd year Information Science and Engineering)

Ref: Proceedings of the 32nd Academic Council meeting held on 28/07/2026 vide agenda no. SSAHE/AC/XXXII-52/2026 .

In exercise of the powers vested under section 6 of 6.05 of MoA / Rules of SSAHE, the Revised Ordinance pertaining to Curriculum of Undergraduate Programme in Bachelor of Engineering disciplines (2nd year Information Science and Engineering) is notified herewith as per Annexure.

By Order,

REGISTRAR

REGISTRAR
Sri Siddhartha Academy of Higher Education
Agalakote, B.H. Road, Tumkur - 572 107.

To,

Dean / Principal, Sri Siddhartha Institute of Technology,

Copy to:

1) **Office of the Chancellor, SSAHE, for kind information,**
2) **PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE**
3) **All Officers of the Academy Examination Branch / Academic Section / Guard File / Office copy.**

Department of Information Science and Engineering
(Accredited by NBA from 2022-28)

Vision of the Department

"To impart knowledge to young aspirants to develop Information Technology based solutions for the Industrial and Societal needs".

Mission of the Department

- Prepare students to acquire knowledge in the field of Information Technology through effective teaching learning methodologies.
- Establish conducive environment for better learning through the state of the art curriculum to exhibit talents and ingenuity.
- Nurture the students to be industry ready by enhancing their employability skills and entrepreneurial skills.
- Develop Information Technology based solution as per the need of Society.

Program Educational Objectives (PEOs)

- To analyse, design and develop Information Technology based solutions using suitable platforms.
- To accomplish any tasks with ethical values and commitment to meet the societal problems.
- To inculcate team work capabilities and managerial skills to become entrepreneur or employee of an organization.
- To instill lifelong learning capabilities and to pursue higher education and research.

Program Outcomes (POs)

1. **Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **Design/Development of Solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. **Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **Individual and Collaborative Team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation,

make effective presentations considering cultural, language, and learning differences.

10. **Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and a leader in a team, and to manage projects and in multidisciplinary environments.
11. **Life-Long Learning**: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

1. Able to apply appropriate techniques for storage of huge amount of data and ensuring its integrity.
2. Choose appropriate method for data acquisition from real world and propose suitable solutions to solve problems.

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION TUMAKURU
(Deemed to be University, Accredited **A+** Grade by NAAC, New Delhi.)
SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU
(A constituent College of Sri Siddhartha Academy of Higher Education, Tumakuru.)
Syllabus for the Academic Year 2026-27

Department of Information Science and Engineering

Scheme of Teaching and Examination for NEP 160 Credits (2025 Scheme)

3RD SEMESTER **ACADEMIC YEAR: 2026-27**

Sl. No.	Category and Course Code		Course Title	Teach. Dept.	Teaching Hrs. / Semester					Credits	Evaluation Marks			SEE Hrs.
					L	T	P	S	Total		CIE	SEE	Total	
1	ASC	25SS301 (CS Stream) 25ES301 (ES Stream) 25MA301 (CV / ME Stream)	Statistics and Probability	MA	42	-	-	48	90	3	50	50	100	3
2	PCC	25IS302	Data Structures and its Applications	ISE	42	-	-	48	90	3	50	50	100	3
3	IPCC	25ISI303	Python for Data Science	ISE	42	-	28	50	120	4	50	50	100	3
4	PCC	25IS304	Operating System	ISE	42	-	-	48	90	3	50	50	100	3
5	PCC	25IS305	Digital Design and Computer Organization	ISE	42	-	-	48	90	3	50	50	100	3
6	PCC	25AI306	Foundations of Artificial Intelligence	ISE	28	-	-	32	60	2	50	50	100	3
7	PCC	25ISL307	Data Structures Laboratory	ISE	-	-	28	2	30	1	50	50	100	3
8	AECL	25ISAEL308	TechEx Laboratory	ISE	14	-	28	18	60	2	50	50	100	3
9	HSC	25IK309	Indian Knowledge System	Any	14	-	-	16	30	1	100	-	100	-
Total					**266**	**-**	**84**	**310**	**660**	**22**	**500**	**400**	**900**	**-**
For lateral entry students only														
1	HSC	25HV310	Universal Human Values	Any	14	-	-	16	30	1	100	-	100	-

L: Lecture, T: Tutorial, P: Practical / Drawing, S: Student Academic Activity. C – Credits, CIE: Continuous Internal Evaluation, SEE: Semester End Examination
Credit Distribution: [Total - 22]: ASC: Applied Science Courses - 3 , PCC: Professional Core Courses - 12, IPCC: Integrated Professional Core Courses – 4, AECL: Ability Enhancement Course Lab. – 2 , HSC: Humanity Science Courses - 1 **CIE Pattern: Integrated Courses**: Theory - 2 CIEs (30 Marks), Periodic Lab. Evaluation (10 Marks), Laboratory IE (10 Marks) [40% min. marks eligibility in each component to write SEE] **Non-integrated Courses:** Theory – 2 CIEs (40 Marks), Activity Based Learning 1 & 2 (5 Marks each) [40% min. marks eligibility to write SEE]

Department: Mathematics			**Semester:**	**III**
Subject: Statistics and Probability (Common to AI&ML, CR, CS, DS, IS, RA)				
Subject Code:	**25SS301**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No	**Course Objectives**
This course will enable the students to :	
1	Introduce the concept of correlation and regression and fitting of a curve,stochastic process
2	Apply discrete and continuous probability distributions for single and two variables in analyzing the probability models arising in engineering field.
3	Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing theory and estimation of parameters
4	To utilize a modern tool for Computations and visualizations.

Module	**Description**	**Hrs**
I	**Statistical Methods:** Correlation and regression- Karl Pearson's coefficient of Correlation, Regression analysis- lines of regression (without proof), rank correlation, problems. **Curve fitting:** Curve fitting by the method of least squares- Fitting of the straight line, second degree parabola and exponential form of the curve $y = ab^x$ (All results without proof)–Problems. Using modern tool to solve and visualize statistical analysis problems. (Text I**:** 25.7,25.12 to 25.14,24.5,24.6,24.8)	**8**
II	**Probability Distributions:** Review of basic probability theory**.** Random variables (Discrete and Continuous), Probability of mass/density functions, Binomial distribution, Poisson's distribution, Exponential distribution and Normal distribution (without derivations) and problems. Solve exact probabilities, plot distributions using modern digital tools. (Text I: 26.7 to 26.9,25.26.14 to 26.16; Text II: 2.1,2.2,2.3)	**8**
III	**Joint probability distributions**: Joint probability distribution for discrete random variables, Mathematical expectations, Covariance and Correlation. **Analysis of variance:** Definition and properties, one way classification, verification within and between treatments. Using modern tool to solve and visualize the joint probability distributions. (Text II: 2.5)	**8**
IV	**Markov Chain:** Probability Vector, Stochastic Matrix, Regular Stochastic Matrix, definition of Markov Chain, Transition Probabilities and Transition probability Matrix, Higher Transition Probabilities, state transition diagram, stationary distribution of regular Markov chains-problems. **Queuing theory**: Introduction, Concepts and M/G/1 and M/M/1 queuing systems-problems. Using modern tool to solve and visualize markov decision process. (Text II: 4.1,8.1)	**9**
V	**Sampling and Statistical Inference:** Sampling distributions, Concepts of hypothesis, standard error and confidence interval, Type-1 and Type-2 errors,	**9**

	Level of significance, One tailed and two tailed tests. Z-test: for single mean, for single proportion. Student's t – distribution, Chi-square test for goodness of fit. Solving and visualizing sampling distributions using modern tools. (Text I: 27.2 to 27.17; Text II: 11.6)	

Text books:

Sl No	Text Book title	Author	Volume and Year of Edition
I	Higher Engineering Mathematics	B.S. Grewal	44th Edition Khanna Publications, 2021.ISBN:9788193328491
II	Introduction to Probability Models	Sheldon M. Ross	Elsevier, 9th Edition, 2007

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Probability, Random variables and Stochastic Process	Athanosios Papoulis & S. Unnikrishna Pillai	Tata McGraw Hill, 4th edition, 2002
2	Higher Engineering Mathematics	B.V.Ramana, Tata McGraw-Hill	11th Edition, Tata McGraw-Hill, 2017, ISBN:9780070634190
3	Statistics Random Processes & Queuing Theory	B.Prabha, P.S. Arunachalum,R. Sujatha	Scitech Publications,2003
4	MATLAB Programming for Engineers	Stephen J Chapman	7th Edition,Cengage,2024, ISBN:9798214001531

Web Links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/111/105/111105035/
- https://nptel.ac.in/courses/111/107/111107119/
- https://www.youtube.com/watch?v=-rQjyUQcFo0
- https://www.youtube.com/watch?v=OXIpBKpOHxk
- https://nptel.ac.in/courses/111103022

Course Outcomes:

Course outcome: After the successful completion of the course, the student will be able to	
CO1	Understand the concepts of Curve Fitting, Correlation, Regression, probability distribution and Markov chain. (L1)
CO2	Formulate and solve mathematical problems on probability distribution, sampling theory, queuing theory and analysis of variance. (L2)
CO3	Analyze the behavior of Markov chain-based problems in the long run and compute the correlation, regression lines, covariance of random variables using joint probability, and queuing theory models in engineering fields. (L2, L3)
CO4	Use modern tool to solve Engineering problems. (L3)
CO5	Analyze the concepts of testing of hypothesis, Analysis of variance, Markov chain, Probability distributions and queuing theory models in solving engineering problems. (L3)

Course Articulation Matrix

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2								
CO2	3	2	1								
CO3	3	3	2								1
CO4					2						1
CO5	3	2		1							1

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering	**Semester**	**III**

Subject: Data Structures and its Applications				
Subject Code:	**25IS302**	**L – T – P –S:**	**42–0–0–48(In Hrs)**	
			Credits:	**3**

Sl. No.	**Course Objectives**
1	Know different methods of storing data in memory and their access.
2	Learn different types of data structures.
3	Understand non-linear data structures and its applications.
4	Learn arranging of data in an order fashion and perform search operation.

Module	**Description**	**Hrs**
I	**Introduction:** Elementary Data Organization, Data structures, Data Structures Operations. **Arrays, Structures and Pointers:** Traversing linear arrays, Inserting and deleting, Multidimensional arrays, Introduction to structure data type, Accessing Structure members, Self-referential structure, pointer and arrays, pointer and structure. **Textbook 1: Chapter 1:** 1.1, 1.2, 1.3, 1.4, **Chapter 4:** 4.5, 4.6, 4.10, 4.12.	**09**
II	**Linked Lists and Stack:** Introduction, Dynamic Memory allocation, Linked lists, Insertion into a linked list, Deletion from a linked list, Traversing a linked list, Searching a linked list, Header Node and its significance , **Stack:** Introduction to Stack, operations on stack, Linked representation of stack. **Textbook 1: Chapter 5: 5.1,5.4,5.5,5.6,5.7,5.8,5.9, Chapter 6: 6.1,6.2,6.3,6.4**	**08**
III	**Applications of Stack, Queues:** Arithmetic expressions, Polish notation, Recursion, Towers of Hanoi, **Queue:** operations on Queue, Circular queue, Dequeues, Priority queues, and Linked representation of queues. **Textbook 1: Chapter 6 :6.6,6.8,6.9,6.11,6.12,6.14,6.15,6.16**	**09**

IV	**Trees:** Introduction, Binary trees, Representing binary trees in memory, Traversing binary trees, Header nodes; Threads, Binary search trees, Searching and inserting in binary search trees, Deleting in a binary search trees. **Textbook 1: Chapter 7: 7.1,7.2,7.3,7.4,7.8,7.9,7.10**	**08**
V	**Sorting and searching:** Introduction, Bubble sort, Insertion sort, Selection sort, Linear search, Binary search. **Graphs and their applications:** Graph theory terminology, Sequential representation of graphs; adjacency matrix; path matrix, Traversing a graph. **Textbook 1: Chapter 4: 4.7,4.8,4.9, Chapter 8: 8.1,8.2,8.3,8.7, Chapter 9: 9.1,9.3,9.4**	**08**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Data Structures with C (Schaum`S Outline Series)	Seymour Lipschutz	Tata McGraw-Hill Education Pvt. Ltd. ISBN 10 - 0070701989 ISBN 13 - 9780070701984

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Data Structure using C	Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein	1st Edition, Pearson publication, 2019, ISBN-13: 9789332543546.
2	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Cengage Publication, 2007, ISBN-13: 9788131503140

E Resources Links:

1. https://www.geeksforgeeks.org/c/learn-dsa-in-c/

2. https://www.w3schools.com/dsa/

3. https://www.codechef.com/roadmap/c-dsa

Course Outcomes:

Course outcome	Descriptions
CO1	**Outline** different types of data structures.
CO2	**Choose** suitable data structures for a given problem.
CO3	**Implement** of data structures and its applications.
CO4	**Apply** concepts of data structures to develop solution for various applications.
CO5	**Check** working and suitability of selected data structure

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3	3	3	2									
CO3	2	2	3	2	2								
CO4	1	2	2	2	2								
CO5	3	2	2	3	1								

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering			**Semester:**	**III**
Subject: Python for Data Science				
Subject Code:	**25ISI303**	**L – T – P - S:**	**42-0-28-50**	**(In Hrs)**
			Credits:	**4**

Sl. No.	**Course Objectives**
1	Understand and apply NumPy arrays for efficient numerical computing and vectorized operations.
2	Apply Pandas data structures and functions for data manipulation, analysis, and preprocessing.
3	Develop Python programs to load, clean, transform, and prepare data from diverse data sources.
4	Apply data wrangling, aggregation, and visualization techniques to analyze datasets and extract meaningful insights.

Module	**Description**	**Hrs**
I	**NumPy Basics**: **Arrays and Vectorized Computation: The NumPyndarray: A Multidimensional Array Object:** Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes, Pseudorandom Number Generation. Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays: Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra. **Textbook 1: Chapter : 4: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6**	**8**
II	**Getting started with pandas**: Introduction to pandas Data Structures: Series, Data Frame, Index Objects, Essential Functionality: Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Summarizing and Computing Descriptive Statistics: Unique Values, Value Counts, and Membership. **Textbook 1: Chapter : 5: 5.1, 5.2, 5.3**	**8**
III	**Data Loading, Storage, and File Formats:** Reading and Writing Data in Text Format: Reading Text Files in Pieces, Writing Data to Text Format, Working with other Delimited	**8**

	Formats, **Data Cleaning and Preparation**: Handling Missing Data, Data Transformation, String Manipulation. **Textbook 1: Chapter: 6 : 6.1, Chapter:7: 7.1, 7.2, 7.4**	
IV	**Data Wrangling: Join, Combine, and Reshape**: Hierarchical Indexing: Reordering and Sorting Levels, Summary Statistics by Level, Indexing with a DataFrame's columns, Combining and Merging Datasets: Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting: Reshaping with Hierarchical Indexing, Pivoting "Long" to "Wide" Format, Pivoting "Wide" to "Long" Format. **Textbook 1: Chapter:8: 8.1, 8.2, 8.3**	**9**
V	**Data Aggregation and Group Operations**: How to Think About Group Operations: Iterating over Groups, Selecting a Column or Subset of Columns, Grouping with Dictionaries and Series, Grouping with Functions, Grouping by Index Levels, Data Aggregation: Column-Wise and Multiple Function Application, Returning Aggregated Data Without Row Indexes, What is Matplotlib?, Matplotlib Getting Started, Matplotlib Pyplot, Matplotlib Plotting, Matplotlib Markers, Matplotlib Line, Matplotlib Labels and Title, Matplotlib Adding Grid Lines, Matplotlib Scatter, Matplotlib Bars, Matplotlib Histograms, Matplotlib Pie Charts. **Textbook 1: Chapter:10: 10.1, 10.2** **https://www.w3schools.com/python/matplotlib_intro.asp**	**9**

Lab Content:

Sl.no	Experiment
1	Using a numpy module create an array and check the following: a) type of an array b) axis of an array c) shape of an array d) type of elements in an array.
2	Using a numpy module create array and check the following: a) List with type float b) 3*4 array with all zeros c) From tuple d) Random values
3	Using a numpy module create array and check the following: a)Reshape 3X4 array to 2X2X3 array b)Sequence of integers from 0 to 30 with steps of 5 c)Flatten array d)Constant value array of complex type.
4	Implement the following using numpy module i) Creation of Arrays

	ii) Demonstrate indexing in numpy array iii) Demonstrate basic operations on single array
5	Using numpy module implement the following i) Replace items that satisfy a condition without affecting the original array ii) Get the positions where elements of two arrays match iii) Compute the row wise counts of all possible values in an array
6	Write a python code to read a csv file using pandas module and print the first and last five lines of a file.
7	Write a Pandas program a) To create and display a DataFrame from a specified dictionary data which has the index labels. b) To select the specified columns and rows from a given DataFrame. c) To rename columns of a given DataFrame. d) To drop a list of rows from a specified DataFrame.
8	Write a Pandas program a) To reset index in a given DataFrame. b) To detect missing values of a given Data Frame. Display True or False. c) To replace NaNs with median or mean of the specified columns in a given Data Frame.
9	Write a Python program using the Pandas library to demonstrate advanced data manipulation techniques involving a)hierarchical indexing, b)data combination, c)merging, d)reshaping, and pivoting.
10	Write a Python program using the Pandas library to perform various a)GroupBy operations, b)data aggregation, on a student dataset containing fields such as Department, Gender, Year, Marks, and Attendance.
11	Write a Python program to plot the marks of students using a line graph with markers, labels, title, and grid.
12	Write a Python program to create a bar chart, scatter plot, histogram, and pie chart using Matplotlib.

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Python for Data Analysis	Wes McKinney	3rd Edition, O'Reilly Media, ISBN: 978-1-098-10403-0, 2022
2	https://www.w3schools.com/python/matplotlib_subplot.asp		

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Data Analytics using Python	Bharti Motwani	1st Edition, Wiley Publications, June 2020, IS N-13: 978-8126502950,

E Resources Links:

1. https://www.learnpython.org/#google_vignette
2. https://www.geeksforgeeks.org/data-science/data-science-with-python-tutorial
3. https://www.w3schools.com/datascience/ds_python.asp
4. https://nptel.ac.in/courses/106106212
5. https://www.udemy.com/course/python-for-data-science-and-machine-learning-bootcamp/?srsltid=AfmBOopr6H5V2-3WfhW7j9FT1XgyROGJmZG8UjUWXl9h777mQVs6ZAZL&couponCode=25BBPMXNVD35
6. https://www.skillindiadigital.gov.in/internship/detail/48
7. https://www.tutorialspoint.com/python_data_science/index.htm

Course Outcomes:

Course outcome	Descriptions
CO1	**Apply** NumPy arrays and vectorized operations to perform numerical computations and statistical analysis.
CO2	**Develop** Python programs using Pandas for data manipulation, transformation, and preprocessing.
CO3	**Analyze** datasets by performing data loading, cleaning, merging, reshaping, aggregation, and GroupBy operations.
CO4	**Create** informative data visualizations using Matplotlib to effectively present analytical results.
CO5	**Perform** data analysis on structured datasets to derive meaningful insights.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			3								
CO2	3	3	2		3								
CO3	2	3	2	2	3								
CO4	2	3	2	3	3								
CO5	2	3	2	3	3				2	2			

Course Assessment and Evaluation: Integrated Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	15	12
		IA-2	90	50	15	
2	Periodic Lab Assessment		-	30	10	4
3	Lab CIE		-	20	5	2
4	One Open Ended Experiment/ Project		-	10	5	2
	Total CIE			**150**	**50**	**20**

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10M) and Viva(5M)-**Total 30M**
Lab CIE: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M)-**Total 20M**
One Open Ended Experiment/ Project: Experimental / project Design (4 marks), Execution/demonstration (3 marks) and Analysis/Viva (3 marks)- **Total 10M**

Semester End Examination(SEE) : **Max 100 Marks,** Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with 2 questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice**.** Each question may have a maximum of 4 sub-divisions**.**
Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering			**Semester:**	**III**
Subject: Operating System				
Subject Code:	**25IS304**	**L – T – P - S:**	**42-0-0-48**	
			Credits:	**3**

Sl. No	**Course Objectives**
1	Understand the structure, organization, and services provided by modern operating systems.
2	Analyze process management, scheduling, synchronization, and deadlock handling techniques used in operating systems.
3	Understand memory management, virtual memory, and storage management mechanisms for efficient resource utilization.
4	Apply operating system concepts and system calls for process, memory, and file management.

Module	**Description**	**Hrs**
I	**Introduction to Operating Systems and System Structures:** What operating systems do, Computer System architecture, Kernel Data Structures, Computing Environment. **Operating System Structures:** System calls, Types of system calls, System programs; Operating System structure. **Textbook 1**: Chapter 1: 1.1, 1.2,1.3,1.9,1.10, Chapter 2: 2.3, 2.8	**08**
II	**Process Management:** Process concept, Process scheduling, Scheduling criteria, Operations on processes, Inter process communication, Scheduling algorithms. Threads concept, Overview, Multithreading models, Threading issues, Thread Libraries. Textbook 1: Chapter 3: 3.1, 3.2,3.3,3.4,3.5,3.6 Chapter 4: 4.1,4.3,4.6,Chapter 5:5.1,5.3,5.4	**08**
III	**Process Synchronization:** Introduction, The Critical section problem, Peterson‟s solution, mutex lock: Semaphores, Monitors, Classical problems of synchronization. **Deadlocks:** System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention and avoidance, Deadlock detection, recovery from deadlock. **Textbook 1**: Chapter 6: 6.2,6.3, 6.5,6.6,6.7 Chapter 7: 7.1 Chapter 8:8.1,8.3,8.4,8.5,8.6,8.7,8.8	**08**
IV	**Memory Management:** Introduction, Contiguous memory	**09**

	allocation, Paging, Structure of page table, Swapping, **Virtual Memory concept:** Demand paging, Copy on write, Page replacement, Allocation of frames, Thrashing. **Textbook 1**: Chapter 9: 9.1, 9.2,9.3,9.4,9.5, Chapter 10: 10.2,10.3,10.4,10.5,10.6	
V	**Secondary Storage Structures:** Disk structure, Disk scheduling, Disk management. **File System Interface:** File concept, Access methods, Directory structure, File protection. **File System Implementation:** File system structure, File system operations, Directory implementation, Allocation methods, Free space management. **Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix. **Textbook 1**: Chapter 11: 11.1,11.2,11.3,11.4, Chapter 13: 13.1, 13.2,13.3,13.4, Chapter 14: 14.1,14.2, 14.3,14.4,14.5, Chapter 17: 17.1, 17.2, 17.4, 17.5	**09**

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating System Concepts	Avi Silberschatz Peter Baer Galvin Greg Gagne	10th Edition, April 15, 2018 John Wiley & Sons, Inc. ISBN 978-1-118-06333-0

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating Systems Internals and Design Principles	William Stallings	9th Edition Pearson education

E Resources Links:

1. https://en.wikipedia.org/wiki/Operating_system
2.https://gfgc.karnataka.gov.in/gfgcmalur/public/uploads/media_to_upload1700646105.pdf
3. https://kdkce.edu.in/writereaddata/fckimagefile/CSE_3RD_OS_101.pdf

Course Outcomes:

Course outcome	Descriptions
CO1	**Demonstrate** an understanding of operating system architecture, structures, and services, and analyze various operating system design methodologies.
CO2	**Apply** process, thread, synchronization, and scheduling techniques to develop efficient concurrent computing solutions.
CO3	**Evaluate** memory, storage, and file management strategies for optimizing system performance and resource utilization.
CO4	**Design** system-level solutions using operating system services, communication mechanisms, and resource management techniques.
CO5	**Assess** operating system protection and security mechanisms for ensuring reliability, integrity, and efficient resource sharing.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1		1						1	2	1
CO2	3	3	2	1	2						1	2	2
CO3	3	3	2	2	2						1	3	1
CO4	3	3	3	2	2						1	3	2
CO5	3	3	2	2	2	1	1				1	3	1

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs

The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering			**Semester:**	**III**
Subject: Digital Design and Computer Organization				
Subject Code:	**25IS305**	**L – T – P - S:**	**42-0-0-48**	**(In Hrs)**
			Credits:	**3**

Sl. No	**Course Objectives**
1	Learn and analyse basic Digital design principles, logic circuit design.
2	Simulate digital circuits using Verilog coding.
3	Understand various machine instruction, input/output, memory and peripherals in digital computer.
4	Learn the arithmetic and logic unit and implementation of fixed-point and Floating point arithmetic unit.

Module	**Description**	**Hrs**
I	**Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-Sums Simplification**. Data Processing Circuits:** Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD-to-decimal Decoders, Encoder. HDL Implementation models and Implementation of Data Processing Circuits. **Text book 1: Module- I:Chapter :3 3.2, 3.3, 3.6, 3.7, 3.11, Chapter 4: 4.1,4.2,4.3, 4.4, 4.6, 4.14**	**8**
II	**Flip-Flops:** Clocked RS, D, JK,T Flip-Flop, Edge-Triggered Flip-Flops(RS, D, JK) Various Representations of Flip-Flops. **Registers & Counters:** Registers: Serial In-Serial Out(SISO), Serial In-parallel out(SIPO),Parallel In-Serial Out (PISO),Parallel In-Parallel Out (PIPO) , Counters:Design of Asynchronous and Synchronous Counters(Mod8 counter), HDL Implementation of Flip-Flops, Registers, Counters. **Module- II : Chapter: 8 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.8, 8.10,8.13 Chapter 9 and Chapter10.**	**8**
III	**Basic Structure of Computers:** Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and	**9**

	Instruction Sequencing, Addressing Modes. **Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses. Standard I/O Interfaces. **Text Book 2:Module-III: 1.1, 1.2, 1.6, Chapter 2: 2.2, 2.3, 2.4, 2.5, Chapter:4 4.1, 4.2, 4.4, 4.5, 4.7.**	
IV	**Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **Module-IV: Chapter 6: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7.**	**9**
V	**Basic Processing unit:** Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic operation, Fetching a word from Memory, Storing a word in Memory. Execution of complete Instruction: Branch Instructions. Multiple-Bus Organization, Hardwire Control, Multiprogrammed Control. **Module-V: Chapter 7: 7.1,7.2, 7.3,7.4, 7.5.**	**8**

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Digital Principles and Applications	Malvino and Leach	8th Edition, McGraw Hill Education,2014 ISB N- : 978-9339203405
2	Computer Organization	Carl Hamachar and Zvonko Vranesic	5th Edition, McGraw Hill Education,2011 ISBN-13 978-1259005275

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Digital Principles and Design	Donald D. Givone	1st Edition, McGraw-Hill Publishers, 2017, ISBN-13: 9780070529069.
2	Computer Organization And Architecture	William Stallings	11th Edition, Pearson, 2019, ISBN

	Designing For Performance		9780134997193.

E Resources Links:

1. https://www.scribd.com
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
4. https://www.youtube.com/playlist?list=PLxCzCOWd7aiFM9Lj5G9G_76adtyb4ef7i

Course Outcomes:

Course outcome	Descriptions
CO1	Able to analyze the working of Digital circuits.
CO2	Design digital circuit to solve a given problem.
CO3	Analyze and implement logic circuits and data path in the processor.
CO4	Outline the internal design and functioning of central processor unit.
CO5	Describe the interaction of I/O devices with central processor unit.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	3	2	1	1	1		2		
CO2	3	3	3	1	3	3	1	1	1		2		
CO3	3	2	3	2	2	2	1	1	1		2		
CO4	2	2	2	1		2	1				2		
CO5	2	1	2	2		3	1	2	1		2		

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs

The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering		**Semester:**	**III**
Subject: Foundations of Artificial Intelligence			
Subject Code:	**25AI306**	**L–T–P-S:**	**28-0-0-32**
		Credits	**2**

Sl. No	Course Objectives
1	**Introduce** basic concepts of Artificial Intelligence.
2	**Learn** the techniques in Artificial Intelligence.
3	**Understand** the Engineering applications and basics of Robotics.
4	**Realize** ethical approaches in Artificial Intelligence.

Module	Description	Hrs
I	**Introduction to Artificial Intelligence:** Definition of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Augmented Intelligence and Cognitive Computing, Machine Learning and Deep Learning. Text Book 1: 1.1-1.5	**5**
II	**Artificial Intelligence Technologies:** Techniques in AI, Machine Learning Model, Types of Machine Learning Algorithms, Regression Analysis in Machine Learning, Working of Regression Analysis, Model Evaluation Metrics, Types of Regression Text Book 1: 2.1-2.3	**6**
III	**Classification Techniques**: K-Nearest Algorithm, Decision Trees, Random Forests **Clustering Techniques**: K-Means Algorithm, Applications of Clustering in Real-World Scenarios, Evaluation Metrics for Clustering, Working of K-Means Algorithm, Pros and Cons of K-Means Algorithm, Density-Based Spatial Clustering of Applications with Noise (Dbscan) Text Book 1: 2.4-2.5	**6**
IV	**AI to all:** AI and Society, AI and Privacy, AI in Healthcare, AI in Finance, AI in Marketing, AI and Automation, AI-Powered Communication, AI in Customer Service, Future Trends in AI, AI for Personal Growth. Text Book 2: 10-21 **Robotics - An Application of AI:** Drones Using AI, Future of AI, No Code AI, Low Code AI Text Book 1: 1.7, 1.8, 1.9, 1.10	**5**

V	**Ethical Decision-Making:** Introduction, Ethical Theories, Values, Ethics in Practice, Implementing Ethical Reasoning**.** **Taking Responsibility:** Introduction, Responsible Research and Innovation, The ART of AI: Accountability, Responsibility, Transparency, Design for Values. Text Book 3: 3, 4, 5-5.1,5.2, 5.3	**6**

Text Books:

Sl. No.	Title	Author	Volume and Year of Edition
1	Artificial Intelligence: Beyond Classical AI,	Reema Thareja	Pearson Education, 2023 ISBN-10 : 9356069328
2	AI for Everyone	Kai L Thornton	eBookIt.com, 2025 ISBN-13 : 978-1456664169
3	Responsible Artificial Intelligence	Virginia Dignum	Springer-Nature New York Inc , 2019 ISBN-10: 3030303705

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Artificial Intelligence Structure and Strategies for Complex Problem Solving	George F Lugar	Pearson Education, 2011, 5th Edition, ISBN-10 : 8131723275
2	Artificial Intelligence A Modern Approach	Stuart Russell & Peter Norvig	Pearson Education, 2010 3rd Edition, ISBN-10 : 9789332543515
3	Artificial Intelligence	Saroj Kaushik	Cengage learning, 2014 1st Edition ISBN-10 : 8131510999

E Resources Links:

1. https://nptel.ac.in/courses/112103280
2. https://www.youtube.com/playlist?list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH
3. https://nptel.ac.in/courses/106106472
4. https://www.youtube.com/watch?v=mmrlkO4vpts

Course Outcomes:

Course outcome	Descriptions
CO1	**Outline** the types of Artificial Intelligence.(L2)
CO2	**Identify** the different Regression models. (L3)
CO3	**Analyze** the classification techniques in Artificial Intelligence.(L4)
CO4	**Extend** the applications of Artificial Intelligence. (L2)
CO5	**Relate** ethical decision making.(L2)

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2	2	2	2	1									
CO3	2	2	2	1									
CO4	2	2	2	1									
CO5	2	1	1	1		2	3						

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering	**Semester:**	**III**

Subject: Data Structures Laboratory				
Subject Code:	**25ISL307**	**L – T – P - S:**	**0-0-28-2**	
			Credit	**1**

Sl. No	**Course Objectives**
1	Develop skills to design and analyze simple linear and nonlinear data structures.
2	Strengthen the ability to identify and apply suitable data structure for the given real world problem.
3	Gain knowledge in practical applications of data structures.
4	Learn to develop a code for various applications using data structures.

LAB CONTENT:

Sl. No	**Experiment Description**
1	**Structures, Pointers and memory representation of records:** Write a C programs to implement: 1. Record of an employee as structure data. 2. Complex number operations using structures. 3. Using Pointer to process dynamic array 4. Insertion and Deletion of element in an array 5. Use pointer to process structure data type. 6. Addition ,subtraction and multiplication of Two Matrices
2	**Linked Lists:** 7. Implement linked list to Insert and deletion of node and display 8. Implement linked list to Insert of node at the end of list, deletion at start and display 9. Create an ordered list 10. Find the largest element in a given linked list. 11. Search the given a node present in the linked list. 12. Insert or Delete a new node at a given position in the linked list. 13. Represent a mathematical equation of n-degree using linked list
3	**Stacks, Queues and their Applications:** 14. Stack operations. 15. Tower of Hanoi using recursion.

	16. Factorial of a given number using recursion. 17. Fibonacci series using recursion. 18. Convert a number from decimal to binary using recursion. 19. Reverse a given array of elements using recursion. 20. Simple queue operations. 21. Circular queue operations.
4	**Trees, Sorting and Searching:** 22. Construct a binary search tree for a set of data and travers the tree using In-order, Pre-order and Post-order. 23. Search an element in an array using binary search. 24. Arrange a set of numbers in an order using insertion sort and selection sort. 25. sort a given set of strings
5	**Programs for self-practice:** 26. Double linked list: Insertion, deletion and display 27. Priority queue operation. 28. Implementing the following graph traversal algorithms: a. Depth First Traversal b. Breadth First Traversal 29. Count the number of nodes in the binary search tree. 30. Sort student records based on marks using structures. 31. Sort an array in descending order. 32. Represent a graph using an Adjacency Matrix. 33. Represent a graph using an Adjacency List. 34. Find the degree of each vertex in a graph. 35. Check whether a path exists between two vertices. 36. Find the connected components of a graph. 37. Find the frequency of an element in an array.

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Structures with C (Schaum`S Outline Series)	Seymour Lipschutz	Tata McGraw-Hill Education Pvt. Ltd. ISBN 10 - 0070701989 ISBN 13 - 9780070701984

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Structure using C	Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein	1st Edition, Pearson publication, 2019, ISBN-13: 9789332543546.
2	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Cengage Publication, 2007, ISBN-13: 9788131503140

E Learning Resources Links:

1.https://mrcet.com/pdf/Lab%20Manuals/CSE/(R18A0584)%20Data%20Structures%20Lab%20Manual.pdf
2. https://studyglance.in/labprograms/dslabprogram.php#google_vignette
3. https://www.scribd.com/document/877569828/DS-LAB-MANUAL#google_vignette

Course Outcomes:

Course outcome	Descriptions
CO1	**Identify** appropriate data structures in program development
CO2	**Develop** a program to solve problems.
CO3	**Able** to perform various operations on data the concept of linked lists in solving problems.
CO4	**Design** and implement solutions for different applications using data structures.
CO5	**Analyze** the solutions developed for different scenarios

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2		3								
CO2	2	3	3		3								
CO3	2	3	3		3								
CO4	2	3	3	2	3	1	1	1	3	3			
CO5	3	3	3	2	2	1	1	1	2	2			

Course Assessment and Evaluation: Lab (Professional / Programme Core Lab)

Continuous Internal Evaluation (CIE): 50 Marks			
Sl.No.	**Components**	**Marks Conducted for**	**40% Min Marks in each component to write SEE**
1	Periodic Lab Assessment	30	12
2	Lab CIE	20	8
	Total CIE	50	20
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10M), Conduction of Experiments(10M) and Viva((5M)-**Total 30M** **Lab CIE**: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M**)-Total 20M**			
Semester End Examination(SEE) : Max 50 Marks, Duration: 3 Hrs **Rubrics for Lab Examination:** Write-up(8M), Conduction/Execution/Demonstration(35M) and Viva(7M)-**Total 50M.** **Minimum passing Marks : 40% of Max Marks**			

Department: Information Science and Engineering	**Semester:**	**III**

Subject: TechEx Laboratory				
Subject Code:	**25ISAEL308**	**L – T – P - S**	**14-0-28-18**	
			Credit	**2**

Sl. No	**Course Objectives**
1	**Master** front-end web development concepts to build responsive, validated user interfaces.
2	**Acquire** hands-on skills in data visualization and business intelligence tools to analyze and interpret data.
3	**Understand** cybersecurity vulnerabilities and gain practical experience in vulnerability scanning and penetration testing tools.
4	**Design** and **implement** functional IoT systems by interfacing sensors and actuators.
5	**Apply** core AI/ML algorithms to solve predictive analysis and natural language processing problems.

PART A(Experimental Learning)

LAB CONTENT

Sl. No	**Experiment Description**
1	**WEB**: Develop a responsive Student Registration Web Page using HTML, CSS, and Bootstrap. The page should contain: • A heading with the college name. • Student details form (Name, USN, Branch, Email, and Phone Number). • Gender selection using radio buttons. • Hobbies using checkboxes. • Submit and Reset buttons.
2	**WEB:** a) Develop and demonstrate, using JavaScript script, a HTML document that collects the USN (the valid format is: A two digits f followed by two upper-case characters followed by three digits no embedded spaces allowed) of the user. Event handler must be included for the form element

	that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected. b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)
3	**Tableau**: Getting Familiar with the Interface & Data Connections Task: a. Open Tableau and connect to an Excel/CSV data source (e.g., Superstore). b. Drag the "Orders" sheet into the canvas area. c. Identify the difference between Dimensions (blue/qualitative fields like Category, Region) and Measures (green/quantitative fields like Sales, Profit). d. Create your first blank worksheet.
4	**Data Analytics using power BI**: Introduction to Power BI Desktop, interface navigation, and connecting to different data sources (Excel, CSV, SQL Server, Web)
5	**Ethical Hacking:** SQL Injection Attack Implementation and Exploitation using SQLmap
6	**Ethical Hacking:** Web Application Vulnerability Scanning using OWASP ZAP and BurpSuite
7	**IOT**: Fire & Motion Detection using an IR Sensor with Actuators
8	**IOT**: Water Quality Monitoring using a pH Sensor
9	**AIML**: Linear Regression for Predicting Student Marks Based on Study Hours
10	**AIML**: Classify movie reviews into “positive" reviews and "negative" reviews, just based on the text content of the reviews. Use IMDB dataset.

Part B

A mini project needs to be developed based on any of the concepts/technologies used in Part A.

Reference Links:

1. **Web:** https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_2/DECAP472_WEB_TECHNOLOGIES.pdf

2. **Tableau**

A. https://www.youtube.com/watch?v=gWZtNdMko1k&list=PLWPirh4EWFpGXTBu8ldLZGJCUeTMBpJFK
B. https://www.youtube.com/watch?v=j8FSP8XuFyk

3. **IOT**
   A. https://www.youtube.com/watch?v=zJ-LqeX_fLU
   B. https://www.youtube.com/watch?v=7DZR5UaAM0E&list=PLEiEAq2VkUUImmTXP_YC2j5qIGOV9NPLy

4. **Power BI**
   A. https://www.youtube.com/watch?v=V-s8c6jMRN0&list=PLO9LeSU_vHCWUvkE1FrGeNxSve7YtJrYl
   B. https://www.youtube.com/watch?v=wZATWjV4scg

5. **Ethical Hacking**
   A. https://www.youtube.com/watch?v=dz7Ntp7KQGA&list=PL9ooVrP1hQOFNILGSLOiflM9kKnEM16Ox
   B. https://www.youtube.com/watch?v=yFC8pb2TPdc&list=PLIhvC56v63IIJZRa3lzK6IeBQOH_VFjUQ

6. **AI**
   A. https://www.youtube.com/watch?v=Yq0QkCxoTHM
   B. https://www.youtube.com/watch?v=VGFpV3Qj4as

Course Outcomes:

Course outcome	Descriptions
CO1	Design responsive web applications using HTML, CSS, and Bootstrap with client-side validation techniques.
CO2	Create interactive data dashboards and connect to varied data sources using Tableau and Power BI.
CO3	Detect and exploit web application vulnerabilities using ethical hacking tools like SQLmap, OWASP ZAP, and BurpSuite.
CO4	Build integrated IoT applications utilizing environmental sensors (IR, pH) and actuators.
CO5	Implement machine learning models for regression analysis and text-based sentiment classification.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	3		2								
CO2	2	3	2	2	3								
CO3	2	3	1	3	3	2							
CO4	3	2	3	2	2	1							
CO5	3	3	3	2	3								

Course Assessment and Evaluation: LAB (Ability Enhancement Course)

This course consists of experimental and project-based learning.

- Part A: 5 weeks of experimental learning with 5 experiments. Students shall conduct the experiments individually. CIE for Part A shall be conducted in the 7th week.
- Part B: 5 weeks of project-based learning. A team of maximum 4 students shall carry out a project. The project shall be completed by the 13th week, CIE for Part B may be conducted in the 14th week.

	Continuous Internal Evaluation (CIE): 50 Marks			
Sl.No	**Components**	**Marks Conducted for**	**Marks Reduced to**	**40% Min Marks in each component to write SEE**
CIE for PART A(Experimental Learning)				
1	Periodic Lab Assessment	30	15	6
2	Lab CIE	20	10	4
	Total CIE for Part A	50	25	10
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10) and Viva(5M)-**Total 30M** **Lab CIE**: Write-up(5M), Conduction/Execution/Demonstration(10M) and				

Viva(5M)**- Total 20M**				
CIE for PART B (Project based Learning)				
1	Lab CIE Part B	50	25	10
	Total CIE(Part A and PartB)	**100**	**50**	**20**
Rubric for Lab CIE Part B: Write-up (10M), Presentation(10M) Demonstration(20M) Viva(10M)- **Total 50 Marks**				
Semester End Examination(SEE) : 50 Marks, Duration: 3 Hrs **PART A (25 Marks):** **Rubrics for Part A:** Write-up(5M), Conduction/Execution/Demonstration(15M) and Viva(5M)-**Total 25M.** **PART B (25 Marks):** **Rubrics for Part B:** Write-up(5M), Presentation/Demonstration(15M) and Viva(5M)-**Total 25M.** **Minimum passing Marks: 40% in Part A and Part B each**				

Department: Humanities and Sciences			**Semester:**	**III**
Subject: Indian Knowledge System				
Subject Code:	**25IK309**	**L – T – P - S:**	**14-0-0-16 (in Hrs)**	
			Credits:	**1**

Sl. No	**Course Objectives**
1	Rejuvenate and mainstream Indian Knowledge Systems by integrating it into the fabric of education research ecosystem
2	Bridge the gap between Traditional Indian Knowledge Systems and contemporary knowledge systems
3	Make a tangible difference to the contemporary world by mainstreaming Indian Knowledge Systems
4	To make the students understand the traditional knowledge, analyze and apply to their day-to-day life.

Module	**Description**	**Hrs**
I	**Introduction to Indian Knowledge Systems:** Meaning, definition and scope of IKS, civilizational continuity of Indian culture, holistic nature of knowledge in India, Gurukul system, Patashalas, Takshashila, Nalanda, overview of Indian philosophical traditions (Darshanas)	**3**
II	**Science and Technology in Ancient & medieval India** Mathematics: Baudhayana Sulba Sutra, Aryabhata, Bhaskara, concept of zero and decimal system; Medicine: Ayurveda, Charaka and Sushruta; Engineering & Technology: Iron Pillar of Delhi, water management systems, town planning, architecture, arts, Astronomy, Astrology, Crafts, Trade in India, Ancient sculptures and monuments, space programs	**3**
III	**Society, Governance and Ethics:** Concept of dharma and social order, ethical teachings in Indian texts, Chanakya's Arthashastra and governance, traditional economic and administrative systems, Anubhava mantapa- first parliament, Indian health systems: Ayurveda and other Indian medicine, Yoga	**3**

IV	**Language, Literature and Knowledge Transmission:** Sanskrit as a scientific language, different languages, Ancient literatures, Books, Indian literary, famous poets and literarists, Indian Inventions and Contributions, Awards	**2**
V	**Indian Cultural Traditions and Practices:** Festivals and cultural diversity of India**,** Traditional family and community systems, social values, folk, arts, music, dance and theatre traditions**,** industrial revolution and indigenous technologies**,** role of traditions in promoting social harmony and cultural identity	**3**

Textbooks:

Sl. No.	Textbook title	Author	Volume and Year of Edition
1	Introduction to Indian Knowledge System-concepts and applications	B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N,	PHI Learning Private Ltd, ISBN-978-93- 91818-21-0, 2022
2	Traditional Knowledge System in India	Amit Jha	Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230, 2009,

Reference Books:

Sl No	Textbook title	Author	Volume and Year of Edition
1	Knowledge Traditions and Practices of India	Kapil Kapoor, Avadesh Kumar Singh	DK Print World (P) Ltd., ISBN 81-246-0334, Vol. 1, 2005
2	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System ,IIT Kharagpur)		

Course Outcomes:

CO1	**Provide** an overview of the concept of the Indian Knowledge System and its importance.
CO2	**Appreciate** the need and importance of protecting traditional knowledge
CO3	**Recognize** the relevance of Traditional knowledge in different domains
CO4	**Establish** the significance of Indian Knowledge systems in the contemporary world.
CO5	**Recognize** the relevance of traditional knowledge in Humanities and Social sciences

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2							3				1	
CO2		1				2				2			
CO3			2										
CO4				2							1		
CO5					3		1						

Course Assessment and Evaluation: Humanities and Social Science Courses (CIP, UHV, Environmental Science, Communicative English, Skill Development)

Sl.No.	Components		Duration(min)	Marks Conducted for	Min Marks To pass the Course
1	Theory-Internal Assessment	IA-1	90	50	40
		IA-2	90	50	
	Total CIE			100	40
IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module					

Department: Humanities and Sciences			**Semester:**	**III**
Subject: Universal Human Values				
Subject Code:	**25HV310**	**L – T – P - S:**	**14-0-0-16 (In Hrs)**	
			Credits:	**1**

Sl. No	**Course Objectives**
1	This introductory course input is intended: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature
4	This course is intended to provide a much needed orientation input in value education to the young enquiring minds.

Module	**Description**	**Hrs**
I	Introduction to Value Education: Understanding Value education. Self-exploration as the process for Value Education. The Basic Human Aspirations and their fulfillment. Right Understanding, Relationship and Physical Facility. Happiness and Prosperity current scenario .Method to fulfill the basic Human Aspirations.	**3**
II	Harmony in the Human Being: Understanding the Human being as the Co existence of the self .Distinguishing between the Needs of the Self and the Body. The Body as an Instrument of the Self. The response of the self and the body. Understanding Harmony in the Self. Harmony of the Self with the Body. Programme to ensure self regulation and health	**3**
III	Harmony in the Family and Society: Understanding Harmony in the Family the basic human Interaction. 'Trust' the Foundational	**3**

	Value in Relationship. 'Respect' – as the right evaluation other Values in Human to human relationship. Understanding Harmony in the society. Vision for the Universal Human Order.	
IV	Harmony in the Nature (Existence): Understanding Harmony in the Nature, interconnectedness, self-regulation, mutual fulfillment among the four orders of nature. Realizing Existence as coexistence at all levels. The Holistic Perception of Harmony in Existence.	**2**
V	Implications of the Holistic Understanding a look at professional Ethics: Basis for universal Human Values. Definitiveness of (Ethical) Human Conduct. Professional Ethics in the light of Right Understanding. A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order. Holistic Technologies, Production Systems and Management models, Typical Case Studies. Strategies for transition towards value based life and profession	**3**

Textbooks:

Sl. No.	Textbook title	Author	Volume and Year of Edition
1	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Sangal G P Bagaria	Excel Books, New Delhi,2010
2	A Foundation Course in Holistic Human Health	Sharmila Asthana, Akhilesh Shukla, T Sundara Raj Perumall	Vol 1,UHV Publications, UHV Foundation, Delhi,2023

Reference Books:

Sl. No.	Textbook title	Author	Volume and Year of Edition
1	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi, 2004
2	Universal human values & professional ethics: uhv	Karthik raj dasari	Vol 1 , Notion Press,2025

Course Outcomes:

CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings family, society, nature they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
CO2	They would have better critical ability, also become sensitive to their commitment towards what they have understood (human values, human relationship and human society
CO3	It is hoped that they would be able to apply what they have learnt to their own self in different day to-day settings in real life, at least a beginning would be made in this direction
CO4	This is only an introductory foundational input. It would be desirable to follow it up by faculty student programs throughout their time
CO5	Leads to form strategies for transition towards Value based life and profession.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3	3	3	2	3			
CO2				2		3	3	3	2	3		1	
CO3				2		3	3	3	2	3	1		
CO4				2		3	3	3	2	3			
CO5				2		3	3	3	2	3		1	

Course Assessment and Evaluation: Humanities and Social Science Courses (CIP, UHV, Environmental Science, Communicative English, Skill Development)

Sl.No.	Components		Duration(min)	Marks Conducted for	Min Marks To pass the Course
1	Theory-Internal Assessment	IA-1	90	50	40
		IA-2	90	50	
	Total CIE			100	40
IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module					

Department of Information Science and Engineering

Scheme of Teaching and Examination for NEP 160 Credits (2025 Scheme)

4TH SEMESTER **ACADEMIC YEAR: 2026-27**

Sl. No.	Category and Course Code		Course Title	Teach. Dept.	Teaching Hrs. / Semester					Credits	Evaluation Marks			SEE Hrs.
					L	T	P	S	Total		CIE	SEE	Total	
1	ASC	25SS401 (CS Stream) 25ES401 (ES Stream) 25MA401 (CV/ ME Stream)	Combinatorics and Advanced Linear Algebra	MA	42	-	-	48	90	3	50	50	100	3
2	PCC	25IS402	Database Management System	ISE	42	-	-	48	90	3	50	50	100	3
3	IPCC	25ISI403	Object Oriented Programming	ISE	42	-	28	50	120	4	50	50	100	3
4	PCC	25IS404	Algorithm Design and Analysis	ISE	42	-	-	48	90	3	50	50	100	3
5	PCC	25IS405	Introduction to Automata Theory and Computation	ISE	42	-	-	48	90	3	50	50	100	3
6	PCC	25ISL406	Database Laboratory	ISE	-	-	28	2	30	1	50	50	100	3
7	AECL	25ISAEL407	UNIX and Shell Programming Laboratory	ISE	14	-	28	18	60	2	50	50	100	3
8	HSS	25CI408	Constitution of India	Any	14	-	-	16	30	1	100	-	100	-
9	EEC	25SK409	Fundamentals of Aptitude and Employability Skills	T&P	14	-	-	16	30	1	100	-	100	-
Total					**252**	**-**	**84**	**294**	**630**	**21**	**550**	**350**	**900**	**-**

For lateral entry students only															
1	HSS	25EN410	Environmental Studies	Any	14	-	-	16	30	1	100	-	100	-	

L: Lecture, T: Tutorial, P: Practical / Drawing, S: Student Academic Activity. C – Credits, CIE: Continuous Internal Evaluation, SEE: Semester End Examination

Credit Distribution: [Total - 21]
ASC: Applied Science Courses - 3
PCC: Professional Core Courses - 10, IPCC: Integrated Professional Core Courses – 4, AECL: Ability Enhancement Course Lab. – 2
HSC: Humanity Science Courses – 1, EEC-Employability Enhancement Courses-1
CIE Pattern:
Integrated Courses: Theory - 2 CIEs (30 Marks), Periodic Lab. Evaluation (10 Marks), Laboratory IE (10 Marks) [40% min. marks eligibility in each component to write SEE]
Non-integrated Courses: Theory – 2 CIEs (40 Marks), Activity Based Learning 1 & 2 (5 Marks each) [40% min. marks eligibility to write SEE]

Department: Mathematics			**Semester:**	**IV**
Subject: Combinatorics and Advanced Linear Algebra (Common to AI&ML, CR CS, DS, IS , RA)				
Subject Code:	**25SS401**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No	**Course Objectives**
This course will enable the students to :	
1	To introduce the concept of generating function, Rook polynomials exponential generating functions.
2	Describe the concepts of Derangements, Rook polynomials, inner products to matrix decomposition.
3	To solve simultaneous algebraic equations using methods of matrix algebra.
4	To utilize a modern tool for Computations and visualizations.

Module	**Description**	**Hrs**
I	**The principle of Inclusion and Exclusion:** The principle of Inclusion and Exclusion, Generalizations of Principle. Derangements, Rook Polynomials, Arrangements with forbidden positions. (Text I: 8.1 to 8.5)	**8**
II	**Generating functions:** Ordinary Generating functions**,** Definition and problems. Calculational Techniques, Partition of Integers, Exponential generating function-problems. (Text I: 9.1 to 9.4)	**8**
III	**Vector spaces**: Solution of system of equations by LU decomposition method. Vector space, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence (all statements only). **Basis and Dimensions:** Basis and Dimensions of Vector space and problems. Use of modern tool for Computations and visualizations of vector spaces. (Text II: 2.4,2.6)	**9**
IV	**Linear transformation:** Introduction, Linear Mappings, Kernel and Image of a linear transformations, Matrix representation of linear transformations, Range space, Null space, Nullity, Rank-Nullity Theorem, Singular and Nonsingular linear transformations (all statements only)-Problems. Solving and visualizing linear transformation using modern tools. (Text II: 2.7)	**9**
V	**Inner Product spaces:** Inner product, norms of a vector, angle between vectors. Orthogonal vectors, orthogonal and orthonormal basis, projections of a vector. Gram-Schmidt orthogonalization process, QR-factorization (all statements only), Singular value decomposition-Problems. Using modern tool to analyze and visualization of orthogonal problems. (Text II: 3.1,3.2,3.5,3.8)	**8**

Text Books:

Sl No	**Text Book title**	**Author**	**Volume and Year of Edition**
I	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	5th edition, 2006, Pearson Education, ISBN-13: 978-81-7758-424-0.
II	Mathematics for Machine Learning	Marc Peter Deisennoh, A. Aldo Faisal, Cheng Soon Ong	ISBN:978-1-108-47004-9

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Linear Algebra and its Applications	Glibert Strang	4th edition, 2006, Cengage Learning India Edition, ISBN: 81-315-0172-8.
2	Introductory Combinatorics	Richard A. Brualdi	5th Edition, 2014, Pearson Prentice Hall, ISBN:978-0136020400.
3	MATLAB Programming for Engineers	Stephen J Chapman	7th Edition,Cengage,2024, ISBN:9798214001531

Web Links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/111105121
3. https://nptel.ac.in/courses/111105035
4. https://nptel.ac.in/courses/111/102/111102152/
5. https://nptel.ac.in/courses/111/105/111105035/

Course Outcomes:

Course outcome	Description
CO1	Understand the concept Principle of inclusion-exclusion, Rook polynomial, generating function, vector space, linear transformations and Inner product spaces. (L1)
CO2	Formulate Rook polynomial, the techniques of QR and singular value decomposition for data compression, LU factorization in solving linear system of equations. (L2)
CO3	Apply the knowledge of Rook polynomial, generating functions, linear algebra to model and solve that appears in engineering sciences. (L2)
CO4	Use of modern tool for Computations and visualizations (L3)
CO5	Analyze the concepts of Principle of inclusion-exclusion, Rook polynomial, generating function, techniques of QR and singular value decomposition for data compression, LU factorization in solving engineering problems. (L3)

Course Articulation Matrix

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									
CO2	3	3	2								
CO3	3	3	2								1
CO4					2						1
CO5	3	2	1								1

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks

Sl.No.	Components		Duration (min)	Marks Conducted for	Marks reduced to	40% Min Marks in each component to write SEE
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs

The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks

Department: Information Science And Engineering			Semester:	IV
Subject: Database Management System				
Subject Code:	25IS402	L – T – P - S:	42-0-0-48	(In Hrs)
			Credits:	3

Sl. No.	Course Objectives
1	Knowledge of the architecture and functioning of Database Management Systems.
2	Understand and apply the principles of data modeling using Entity Relationship and develop a good database design.
3	Understand the use of Structured Query Language (SQL) and NoSQL.
4	Apply normalization techniques to normalize a database and understand the need of database transaction.

Module	Description	Hrs
I	**Introduction:** Introduction with an example, Characteristics of Database approach, Actors on the scene, Workers behind the scene, Advantages of using DBMS approach, when not to use a DBMS. Data models, schemas and instances, Three schema architecture and data independence, Database languages and interfaces, The database system environment, Centralized and client-server architectures. **Textbook 1: Chapter:1 1.1,1.2,1.3,1.4,1.5,1.6,1.8, Chapter: 2 2.1, 2.2, 2.3, 2.4, 2.5**	09
II	**Data Modeling using the Entity-Relationship (ER) Model:** Using High-Level Conceptual, Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship types of degree higher than two. Relational Database Design, Using ER- to-Relational Mapping. **Relational Model:** Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and dealing with constraint violations. **Textbook 1: Chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.9, 9.1**	09
III	**SQL:** Data Definition and Data Types, Specifying constraints in SQL, Basic queries in SQL, Insert, Delete and Update	08

	statements in SQL, More complex SQL Queries, Views (Virtual Tables) in SQL, Schema change statements in SQL, **Database Stored Procedures and SQL/PSM:** Database Stored Procedures and Functions, SQL/PSM: Extending SQL for Specifying Persistent Stored Modules. **Text 1:6.1, 6.2, 6.3, 6.4, 7.1,7.3,7.4,10.4**	
IV	**Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms. Introduction to transaction processing: Transaction and system concept, desirable properties of transactions. Characterizing Schedules Based on Serializability. **Textbook 1: Chapter: 14 14.1,14.2,14.3, 14.4, 20.1,20.2, 20.3, 20.5**	**08**
V	**Introduction to NoSQL (Not Only SQL):** Where is it used? , what is it?, Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, What we miss with NoSQL?, use of NoSQL in industry, NoSQL vendors, SQL versus NoSQL, NewSQL Introduction, Comparision of SQL, NoSQL and NewSQL. **Introduction to MongoDB:** What is MongoDB?, Why MongoDB?, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language **Textbook 2: Chapter: 4 4.1, Chapter 6**	**08**

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Database Systems	Elmasri and Navathe	7thEdition, Pearson Education, 2017, ISBN-13: 978 9332582705.
2	Bigdata And Analytics	SeemaAcharya, Subhashini Chellappan, Infosys Limited	Publication: Wiley India Private Limited,2nd Edition 2020. ISBN-13 : 978-8126588367

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Database Management Systems	Raghu Ramakrishnan and Johannes Gehrke	3rd Edition, McGrawHill, 2014, ISBN-13:978-9339213114.
2	An Introduction to Database Systems	C.J. Date, A. Kannan, S. Swamynatham	8th Edition, Pearson education, 2017, ISBN-13:978-817585568.

E Resources Links:

1. https://youtu.be/c5HAwKX-suM?si=3bkcDgF6zQ4-oUpB
2. https://youtu.be/YRnjGeQbsHQ?si=cRKzcWGw8NgjYFP1
3. https://youtu.be/xOCaT4KYvqs?si=XA_rNLXvh6adK99e
4. https://nptel.ac.in/courses/106105175

Course Outcomes:

Course outcome	Descriptions
CO1	**Explain** the characteristics, architecture, and functioning of a DBMS.
CO2	**Design** and model real-world problems using the ER model and transform them into relational schemas.
CO3	**Construct** and execute SQL queries including DDL, DML, views, and stored procedures.
CO4	**Apply** normalization for Relational schema to design optimized relational database and analyze concepts and properties of transactions.
CO5	**Analyze** modern database paradigms including **SQL, NoSQL**, and **NewSQL**, and utilize **MongoDB** to model, store, and manipulate data for scalable application development.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1							1			
CO2	3	2	2						1	1			
CO3	3	2	3	1	2					1			
CO4	3	3	2	2						1			
CO5	3	3	2	2	3					1	2		

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks

Sl.No.	Components		Duration (min)	Marks Conducted for	Marks reduced to	40% Min Marks in each component to write SEE
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs

The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks

Department: Information Science And Engineering			Semester:	IV
Subject: Object Oriented Programming				
Subject Code:	25ISI403	L – T – P - S:	42-0-28-50 (In Hrs)	
			Credits:	4

Sl. No.	Course Objectives
1	Understand the fundamentals of object-oriented programming.
2	Know the principles of inheritance, packages and interfaces.
3	Learn exception handling mechanism for reliable solutions.
4	Write Object oriented programs to solve real world problems.

Module	Description	Hrs
I	**Introduction to Object oriented programming:** Fundamentals of Object Oriented Programming- Introduction, Object-Oriented Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP. An Overview of Java -First Simple Java program: Entering the Program, Compiling the Program, A Closer Look at the First Sample Program, A Second short program, Java is a Strongly Typed Language. Introducing Classes: Class Fundamentals: The General Form of a Class, A Simple Class, Declaring Objects: A Closer Look at new, Assigning Object Reference Variables, Introducing Methods: Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameters, Constructors: Parameterized Constructors, The this Keyword: Instance Variable Hiding, Garbage Collection, A Stack Class. **Textbook 2: Chapter 1: 1.1,1.2,1.3,1.4,1.5** **Textbook 1: Chapter 2 : Chapter 6**	**08**
II	**Classes and Methods:** A Closer Look at Methods and Classes: Overloading Methods: Overloading Constructors, Using Object as parameter, A Closer Look at Argument Passing, Returning Object, Introducing Access Control, Understanding Static, Introducing Final, Arrays Revisited, Introducing Nested and Inner Classes. Exploring the String Class, Using Command-Line Arguments. **Textbook 1: Chapter 7**	**08**

III	**Inheritance:** Inheritance Basics: Member Access and Inheritance, A More Practical Example, A Superclass Variable Can Reference a Subclass Object, Using Super: Using super to Call Superclass Constructors, A Second Use for super, Creating Multi-Level Hierarchy, when Constructors are Executed, Method Overriding, Dynamic Method Dispatch: Why Overridden Methods?, Applying Method Overriding, Using Abstract Classes, Using Final with Inheritance: Using final to Prevent Overriding, Using final to Prevent Inheritance, The Object Class. **Textbook 1: Chapter 8**	**09**
IV	**Packages and Interface:** Packages: Defining a Package, Finding Packages and CLASSPATH, A Short Package Example, Access protection: An Access Example, Importing Packages. **Interfaces:** Defining an Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Interfaces Can Be Extended, Default Interface Methods: Default Interface Methods, A More Practical Example, Multiple Inheritance Issues, Use Static Methods in an Interface. **Textbook 1: Chapter 9**	**08**
V	**Exception Handling and Enumerations:** Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch: Displaying a Description of an Exception, Multiple Catch Clauses, Nested try Statements, throw, throws, finally, Java's built-in Exceptions, Creating your own Exception Subclasses. Chained Exceptions. Three Recently Added Exception Features. **Enumerations:** Enumeration Fundamentals, The values() and valueOf() Methods ,Java Enumerations Are Class Types, Enumerations Inherit Enum, Another Enumeration Example. **Textbook 1: Chapter 10 ; Chapter 12**	**09**

LAB CONTENT:

Sl. No.	Experiment Description
1	Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2	Write a java program which reads your name and other details through command line and print them.

3	Write a Java Program that simulates the "wc" command of Unix Operating System. **Note:** The String of text should be Hardcoded in the program itself.
4	Write a Java program that implements Bubble sort algorithm for sorting in descending order and also shows the number of interchanges occurred for the given set of integers.
5	Write a Java program to search for an element in a given list of elements using binary search mechanism.
6	Write a Java program to find the area and volume of a room. Use a base class rectangle with a constructor and a method for finding the area. Use its subclass room with a constructor that gets the value of length and breadth from the base class and has a method to find the volume. Create an object of the class room and obtain the area and volume.
7	Design a class named Triangle to represent a triangle. The class contains: i. Three double instance variables named side1, side2 and side3 that specify the three sides of the triangle. The default values are 1 for all the sides. ii. A no-arg constructor that creates a default triangle. iii. A constructor that creates a triangle with the specified sides. iv. A get method to return the value of the instance variables. v. A set method to set a new value of the instance variables. vi. A method named getArea() that returns the area of this triangle. vii. A method named getPerimeter() that returns the perimeter. Write a test program that creates two Triangle objects. Assign sides 4, 5 and 6 to the first object and 1.5, 2.5 and 3.5 to the second object. Display the properties of both objects and find their areas and perimeters. (Hint: To find square root of a number use Math.sqrt function). **Note:** Modify the program so that inputs can also be read from Standard Input Device, the keyboard.
8	Design a class named Stock that contains: i. A string data field named symbol for the stocks symbol ii. A string data field named name for the stocks name. iii. A double data field named previousClosingPrice that stores the stock price for the previous day. iv. A double data field named CurrentPrice that stores the stock price for the current time. v. A constructor that creates a stock with specified symbol and name.

	vi. The accessor method for all data fields vii. The mutator method for previousClosingPrice and CurrentPrice. viii. A method named getchangePrecentage () that returns the percentage changed from previous closing price to current price. Write a test program that creates a stock object with the stock symbol SUNW, the name Sun Micro System Inc., and the previous price of 100 set a new current price to go and display the price-change percentage.
9	Write a Java Program to create an abstract class named shape that contains two integers and an empty method named printArea. Provide three classes named Rectangle, Triangle and Circle subclass that each one of the classes extends the Class Shape. Each one of the classes contains only the method printArea() that prints the area of Shape. **Note:** Read the input from the keyboard using Scanner Class.
10	Design a simple Java program to demonstrate different combinations of access control modifiers for: same package subclass, same package non-subclass, different package subclass, different package non-subclass. **Note:** Justify the result with the Access Protection table.
11	Consider the trunk calls of a telephone exchange. A trunk call can be ordinary, urgent or lightning. The charges depend on the duration and the type of the call. Write a program using the concept of polymorphism in Java to calculate the charges.
12	Write a program in Java to create a Player class. Inherit the classes Cricket _Player, Football _Player and Hockey_ Player from Player class.
13	The MyPoint class was created to model a point in a two- dimensional space. The MyPoint class has the properties x and y that represents x and y coordinates, two get methods for x and y and the method for returning the distance between two points. Create a class named ThreeDPoint to model a point in a three- dimensional space. Let ThreeDPoint be derived from MyPoint with the following additional features: i. A data field named z that represents the z-coordinate ii. A no-arg constructor that constructs a point with coordinates (0, 0, 0). iii. A constructor that constructs a point with three specified coordinates. iv. A get method that returns the z value. v. The distance method to return the distance between two points in the three-dimensional space.

	Implement the classes. Write a test program that creates two points (0, 0, 0) and (10, 30, 25.5) and display the distance between the two points.
14	Write a Java Program for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
15	Write a Java program which has: i. An interface for Stack Operations. ii. A class that implements the Stack Interface and creates a fixed length Stack. iii. A class that implements the Stack Interface and creates a dynamic length Stack. iv. A class that uses both the above Stacks through interface reference and does the stack operations that demonstrate the runtime binding.
16	Write a program to make a package Balance in which has Account class with Display_Balance method in it. Import Balance package in another program to access Display_Balance method of Account class.
17	On a single track two vehicles are running. As vehicles are going in same direction there is no problem. If the vehicles are running in different direction there is a chance of collision. To avoid collisions, write a Java program using exception handling. You are free to make necessary assumptions.
18	Write a Java program that demonstrates: i. Checked Exception ii. Unchecked Exception iii. Create your own exception subclasses
19	Write a java program to perform simple command line calculator with an exception handler that deals with nonnumeric operands; then write another program without using an exception handler to achieve the same objective. Your program should display a message that informs the user of the wrong operand type before exiting.
20	Write a JAVA program to create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method isWorkday( ) to the DayofWeek class that returns true if the value on which it is called is MONDAY through FRIDAY.

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Java - The Complete Reference	Herbert Schildt	12th Edition, Tata McGraw Hill, 2022, ISBN: 978-1-26-046342-2
2	Programming With Java	E Balagurusamy	6th Edition, Tata McGraw Hill, 2019, ISBN: 978-93-5316-234-4

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to JAVA Programming, Comprehensive Version 10e	Y. Daniel Liang	10th Edition, Pearson Education, 2018, ISBN-13:978-9353065782

E Resources Links:

1.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012824074957201408682 91_shared/overview
2. https://www.geeksforgeeks.org/java/java/
3. https://www.hackerrank.com/domains/java

Course Outcomes:

Course outcome	Descriptions
CO1	**Analyze** object-oriented programming principles and Java language features for developing modular and reusable software solutions.
CO2	**Apply** classes, objects, methods, inheritance, interfaces, and packages to model and implement real-world software systems.
CO3	**Design** object-oriented solutions using abstraction, encapsulation, inheritance, polymorphism, and dynamic binding techniques.

CO4	**Develop** robust and reliable Java applications using exception handling, access control mechanisms, and appropriate programming construct.
CO5	**Evaluate** and **implement** object-oriented software solutions to solve real-world problems using modern programming tools and development environments.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1		2						1	1	
CO2	3	3	2	1	2						1	1	2
CO3	2	3	3	2	3				1		1	2	2
CO4	2	3	2	3	3		1				1	2	2
CO5	2	3	3	2	3				1	1	2	2	3

Course Assessment and Evaluation: Integrated Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	15	12
		IA-2	90	50	15	
2	Periodic Lab Assessment		-	30	10	4
3	Lab CIE		-	20	5	2
4	One Open Ended Experiment/ Project		-	10	5	2
	Total CIE			**150**	**50**	**20**

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10M) and Viva(5M)-**Total 30M**

Lab CIE: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M)- **Total 20M** **One Open Ended Experiment/ Project:** Experimental / project Design (4 marks), Execution/demonstration (3 marks) and Analysis/Viva (3 marks)- **Total 10M**
Semester End Examination(SEE) : **Max 100 Marks,** Duration: 3 Hrs The question paper shall contain 10 full questions (20 marks each)**,** with 2 questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice**.** Each question may have a maximum of 4 sub-divisions**.** **Minimum passing Marks : 40% of Max Marks**

Department: Information Science and Engineering			Semester:	IV
Subject: Algorithm Design and Analysis				
Subject Code:	25IS404	L – T – P - S:	42-0-0-48	(In Hrs)
			Credits:	3

Sl. No.	Course Objectives
1	Understand basic efficiency classes and asymptotic notations to express the complexity of algorithms.
2	Determine a suitable algorithm design technique for effective problem solving.
3	Analyze the algorithm with respect to space and time complexity.
4	Comparison of algorithm efficiency in different design techniques.

Module	Description	Hrs
I	**Introduction, Fundamentals of the Analysis of Algorithm Efficiency, Brute Force:** Algorithm Definition, Fundamentals of algorithmic problem solving, Analysis Framework, Formal Definitions of Asymptotic Notations, Basic efficiency classes, Mathematical analysis of Non-Recursive and recursive Algorithms with Examples. **Brute Force**: String Matching. **Text book 1:** 1.1, 1.2, 2.1-2.4, 3.2	**08**
II	**Divide and Conquer:** Merge Sort, Quick Sort, Finding the Maximum and Minimum. **Decrease and Conquer**: Insertion Sort, Topological Sorting. **Text book 1:** 5.1, 5.2, 4.1, 4.2	**08**
III	**Transform and Conquer:** AVL Trees and Heaps and Heap Sort **Space and Time Tradeoffs:** Input Enhancement in String Matching- Horspool‟s algorithm, Hashing: Hash table, Hash functions, Collision handling by open addressing and chaining. **Text book 1:** 6.3, 6.4, 7.2, 7.3	**09**
IV	**Greedy Technique:** Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm. **Dynamic Programming:** Floyd's Algorithm, Knapsack Problem and Memory Functions. **Text book 1:** 8.2, 8.4, 9.1- 9.3	**09**
V	**Back tracking:** n-Queen's Problem, Subset-Sum Problem. **Branch and Bound:** Assignment Problem, Knapsack Problem, and Traveling Salesman Problem**.** **Text book 1:** 12.1, 12.2	**08**

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to the Design & Analysis of Algorithms	Anany Levitin	3rd Edition, Pearson Education, 2017, ISBN-13: 978-0-13-231681-1

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to Algorithms	Cormen T.H, Leiserson C.E.&Rivest R.L	4th Edition, PHI, 2022, ISBN- 13: 978-0262033848
2	Algorithm Design	Jon Kleinberg and Eva Tardos,	1st Edition, Pearson, 2013 978-1292037042.
3	Design and Analysis of Algorithms	Michael T. Goodrich , Roberto Tamassia	Ist Edition, Wiley publications 2021 , 978-9354248481
4	Computer Algorithms/C++	Ellis Horowitz, SatrajSahni and Rajasekaran	2nd Edition, 2019, Universities Press, ISBN-13: 978-8173716119

E Resources Links:

1. https://www.geeksforgeeks.org/dsa/analysis-of-algorithms/
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
3. https://www.youtube.com/watch?v=ovz54KoZo9o
4. https://www.youtube.com/watch?v=pULw1Fpru0E

Course Outcomes:

Course Outcome	Descriptions
CO1	**Understand** the basic concepts of algorithm analysis.
CO2	**Demonstrate** various algorithm design techniques.

CO3	**Design** an algorithm for the given problem.
CO4	**Apply** the appropriate algorithm design technique to solve the given problem instance.
CO5	**Analyze and compare** algorithms based on their time and space complexity.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2										
CO2	2	3	3	3							2		
CO3	2	2	3	3									
CO4	2	3	3	3									2
CO5	2	2	3	3									

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz),

Student Development program(1 week/online or offline), ……Etc
Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions. **Minimum passing Marks : 40% of Max Marks**

Department: Information Science and Engineering			Semester:	IV
Subject: Introduction to Automata Theory and Computation				
Subject Code:	25IS405	L – T – P - S:	42-0-0-48	(In Hrs)
			Credits:	3

Sl. No.	Course Objectives
1	Understand core concepts in Automata and Theory of Computation.
2	Know different Formal Language Classes and their Relationships.
3	Prove or disprove theorems in Automata Theory.
4	Compare finite automata, Push Down Automata and Turing Machines as Mathematical models of computation.

Module	Description	Hrs
I	**Finite Automata:** Definition of Deterministic Finite Automata, How a DFA processes strings, Simpler notations for DFA's, Extending the transition function to strings, The language of a DFA, Nondeterministic Finite Automata (NFA): Definition of NFA, An Extended Transition Function, The language of NFA, Equivalence of DFA and NFA, Finite Automata with Epsilon- transitions. **Textbook 1: Chapter 2: 2.2.1, 2.2.2, 2.2.3,2.2.4,2.2.5,2.3.2,2.3.3,2.3.4,2.3.5,2.5**	9
II	**Regular Expressions and Languages:** Regular Expression, Converting DFA's to Regular Expressions by eliminating states, Converting Regular Expressions to Automata, Applications of Regular Expressions. Equivalence and minimization of Automata: Testing Equivalence states, Testing Equivalence of Regular Languages, Minimization of DFA. **Textbook 1: Chapter 3:3.1, 3.2.2,3.2.3,3.3** **Chapter 4:4.4.1,4.4.2,4.4.3**	8
III	**Context-Free Grammars:** Definition of Context-Free Grammars, Derivations using a Grammar, The language of a grammar, Sentential forms, Parse Trees: Constructing Parse Trees, The yield of a Parse tree, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages: Ambiguous grammars, Removing Ambiguity in grammar, Inherent Ambiguity. **Textbook 1: Chapter 5:5.1.2,5.1.3,5.1.5,5.1.6,5.2.1,5.2.2,5.3,5.4.1,5.4.2,5.4.4**	8

IV	**Properties of Context-Free Languages:** Normal Forms for CFGs: Eliminating Useless Symbols, Eliminating ϵ-Productions, Eliminating Unit Productions, Chomsky Normal Form. **Pushdown Automata:** Formal Definition, A Graphical Notation for PDA's, Instantaneous Descriptions of a PDA, The Languages of a PDA, Acceptance by Empty Stack and Final State. **Textbook 1: Chapter 7:7.1:7.1.1,7.1.3,7.1.4,7.1.5, Chapter 6:6.1.2,6.1.3,6.1.4,6.2: 6.2.1,6.2.2**	**8**
V	**Introduction to Turing Machines:** The Turing Machine: Notation for the Turing Machine, Instantaneous Descriptions for Turing Machines, Transition Diagrams for Turing Machines, The Language of a Turing Machine, Turing machines and Halting. **Textbook 1: Chapter 8:8.2:8.2.2,8.2.3,8.2.4,8.2.5,8.2.6**	**9**

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to Automata Theory, Languages and Computation	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman	Third Edition, Pearson-2023 ISBN: 9788131720479

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to Languages and Theory of Computation	John C Martin	3rd Edition, Tata McGraw –Hill Education, 2013 ISBN. 978-0-07-066048-9.
2	An introduction to Formal Languages and Automata	Peter Linz	7th Edition, 2022. ISBN: 9781284231601 / 9781284231618

E Resources Links:

1. https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/resources/introduction-finite-automata-regular-expressions/

2. https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/resources/introduction-finite-automata-regular-expressions/

3. https://www.tutorialspoint.com/automata_theory/index.htm

Course Outcomes:

Course outcome	Descriptions
CO1	**Explain** the concepts of automata theory and its applications.
CO2	**Design** computational models to accept a given language and vice versa.
CO3	**Demonstrate** the equivalence among different computational models.
CO4	**Design** and simulate automata models to accept a given language.
CO5	**Simplify** the given computational model using minimization techniques.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2								1		2	
CO2	3	3	2		2					1		3	
CO3	3	3	3	2						1		3	2
CO4	3	2	2		2					1		3	
CO5	3	3	2	2	3					1	1	3	2

Course Assessment and Evaluation: Regular Theory Courses

Continuous Internal Evaluation (CIE): 50 Marks

Sl.No.	Components		Duration (min)	Marks Conducted for	Marks reduced to	40% Min Marks in each component to write SEE
1	Theory-Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs

The question paper shall contain 10 full questions (20 marks each)**,** with **2** questions from each of the 5 Modules**,** ensuring 100% syllabus coverage**.** Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks

Department: Information Science and Engineering			Semester:	IV
Subject: Database Laboratory				
Subject Code:	25ISL406	L – T – P – S:	0 – 0 –28 –2	
			Credits:	1

Sl. No.	Course Objectives
1	Understand how a real world problem can be mapped to schemas.
2	Solve different industry level problems & to learn its applications.
3	Emphasize the importance of normalization in databases.
4	Solve different industry level problems & to learn its applications.

LAB CONTENT:

Sl. No.	Experiment Description
Cycle- 1	Consider the following schema for Insurance database: PERSON (driver_id , name, address) CAR (regno, model, year) ACCIDENT (reportno, accd_date, location) OWNS (driver_id, regno) PARTICIPATED (driver_id, regno, reportno, damage_amt)
	Consider the following database schema for student database: STUDENT (usn, name, major, date) COURSE (courseno, cname, dept) TEXT (book_ISBN, book_title, publisher, author) ENROLL (usn,courseno, sem, marks) BOOK _ ADOPTION (courseno, sem, book_ISBN)
	Consider the schema for Company Database: DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DLOCATION (DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN,PNo, Hours)
	Consider the following schema for Movie Database: ACTOR (Act_id, Act_Name, Act_Gender) DIRECTOR (Dir_id, Dir_Name, Dir_Phone)

	MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id MOVIE_CAST (Act_id,Mov_id, Role RATING (Mov_id, Rev_Stars)
	Consider the following database schema for Salesman database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Cycle-2	Querying Data using MongoDB 1. Create a collection named "products" with fields: "name", "category", "price" and "stock". 2. Insert multiple documents into the "products" collection. 3. Write queries to find all products in a specific category. 4. Retrieve products with a price less than a certain value. 5. Find products that are out of stock. 6. Count the number of products in a specific category.
	Aggregation Framework 1. Create a collection named "orders" with fields: "order_date", "total_amount", and "customer_id". 2. Insert orders into the "orders" collection. 3. Write an aggregation pipeline to calculate the total sales per month. 4. Calculate the average order amount for each customer. 5. Find the customer with the highest total order amount. 6. Group orders by year and month and calculate the total revenue for each period.
	Implement MongoDB queries using CRUD operations for a restaurants collection For the structure of “Restaurants“ collection 1. Write a MongoDB query I. to display all the documents in the collection restaurants. 2. To display the fields restaurant_id, name, borough and cuisine for all the documents in the Collection restaurant. 3. To display the fields restaurant_id, name, borough and cuisine, but exclude the field _id for all the documents in the collection restaurant 4. To display all the restaurant which is in the borough Bronx

	5. To display the first 5 restaurant which is in the borough Bronx. 6. To find the restaurants who achieved a score more than 90 7. To find the restaurants that achieved a score, more than 80 but less than 10

Instructions:

Using given schema:

1. Draw an Entity-Relationship (ER) Model.
2. Implement SQL Queries using DDL and DML Statements.
3. Implement SQL Nested queries and Views.
4. Create and query views in MongoDB to present customized representations of data for specific application requirements.

Text books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Database Systems	Elmasri and Navathe	7thEdition, Pearson Education, 2017, ISBN-13: 978 9332582705.
2	Bigdata And Analytics	SeemaAcharya, Subhashini Chellappan, Infosys Limited	Publication: Wiley India Private Limited,2nd Edition 2020. ISBN-13 : 978-8126588367

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Database Management Systems	Raghu Ramakrishnan and Johannes Gehrke	3rd Edition, McGrawHill, 2014, ISBN-13:978-9339213114.
2	An Introduction to Database Systems	C.J. Date, A. Kannan, S. Swamynatham	8th Edition, Pearson education, 2017, ISBN-13:978-817585568.

E Resources Links:

1. https://youtu.be/c5HAwKX-suM?si=3bkcDgF6zQ4-oUpB
2. https://youtu.be/YRnjGeQbsHQ?si=cRKzcWGw8NgjYFP1
3. https://youtu.be/xOCaT4KYvqs?si=XA_rNLXvh6adK99e
4. https://nptel.ac.in/courses/106105175
5. https://youtu.be/5OdVJbNCSso?si=I3zA36TV4Q9nUHlG
6. https://youtu.be/WXk7yDqsKxs?si=fwVcAZR7D6BGgrvg
7. https://youtu.be/xiUTqnI6xk8?si=CqVrobcFBw-4bN-P

Course Outcomes:

Course Outcome	Descriptions
CO1	**Design** database schemas and data models using Entity-Relationship (ER) diagrams and map them to relational and NoSQL database structures.
CO2	**Implement** database operations using SQL DDL and DML statements to create, modify, populate, and manage relational databases.
CO3	**Develop** and execute SQL queries, including joins, nested queries, views, and aggregate functions, to retrieve and manipulate data effectively.
CO4	**Apply** and implement MongoDB collections and documents for storing structured, semi-structured, and unstructured data.
CO5	**Execute** MongoDB Query Language (MQL) commands for data insertion, retrieval, updating, deletion, and querying nested documents and arrays.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	3	2					1			
CO2	3	3	2	1	2					1			
CO3	3	2	3	3	3					1			
CO4	3	2	3	1	3				2	2	2		
CO5	2	1	2	3	3				1	1	3		

Course Assessment and Evaluation: Lab (Professional / Programme Core Lab)

Continuous Internal Evaluation (CIE): 50 Marks			
Sl.No.	**Components**	**Marks Conducted for**	**40% Min Marks in each component to write SEE**
1	Periodic Lab Assessment	30	12
2	Lab CIE	20	8
	Total CIE	50	20
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10M), Conduction of Experiments(10M) and Viva((5M)-**Total 30M** **Lab CIE**: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M**)-Total 20M**			
Semester End Examination(SEE) : Max 50 Marks, Duration: 3 Hrs **Rubrics for Lab Examination:** Write-up(8M), Conduction/Execution/Demonstration(35M) and Viva(7M)-**Total 50M.** **Minimum passing Marks : 40% of Max Marks**			

Department: Information Science and Engineering			Semester:	IV
Subject: UNIX and Shell Programming Laboratory				
Subject Code:	25ISAEL407	L – T – P - S:	14-0-28-18	(In Hrs)
			Credits:	2

Sl. No.	Course Objectives
1	Understand the UNIX Operating System architecture and its functionalities.
2	Gain important aspects of file system and file attributes.
3	Familiar with utilities provided by UNIX.
4	Learn how to use UNIX editor environment.

Laboratory Contents:

1	Write a Shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, outputs the common permissions, otherwise outputs each file name followed by its permissions.
2	Write a Shell script that takes a valid directory name as an argument and recursively descends all the subdirectories, finds the maximum length of any file in that hierarchy and writes this maximum value to the standard output.
3	Write a Shell script that accepts valid log-in names as arguments and prints their corresponding home directories. If no arguments are specified, print a suitable error message.
4	Write a Shell script to that accepts path names and creates all the components in that path name as directories. For example, if the script name is mpe, then the command mpe a/b/c/d should create directories a, a/b, a/b/c and a/b/c/d.
5	Write a Shell script to find and display all the links to a file specified as the first argument to the script. The second argument, which is optional, can be used to specify the directory in which the search is to begin. If this second argument is not present, the search is to begin in current working directory. In either case, the starting directory as well as all its subdirectories at all levels must be searched. The script need not include any error checking
6	Write a Shell script that reports the logging in of a specified user within one minute after he/she log in. The script automatically terminated if specified user does not log in during a specified period of time.

7	Write a Shell script that determine the period for which a specified user is working on system.
8	Write a Shell script that accept a list of filenames as its argument, count and report occurrence of each word that is present in the first argument file on other argument files.
9	Write a Shell script that deletes all lines containing a specific word in one or more file supplied as argument to it.
10	Write a Shell script that accepts file names specified as arguments and creates a shell script that contains this file as well as the code to recreate these files. Thus if the script generated by your script is executed, it would recreate the original files.

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	UNIX Concepts and Applications	Sumitabha Das	4th Edition, Tata McGraw Hill, 2018. ISBN-13 978-0070635463

E Resources Links:

1. https://www.unix.org/overview.html
2. https://www.linux.org/pages/download/

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the architecture and features of UNIX Operating System.
CO2	**Use** File system and basic file system commands.
CO3	**Interpret** various UNIX utilities to manage file processing operations.
CO4	**Explain** how to use various commands available in editor environment.
CO5	**Develop** UNIX script to solve given problem

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1											
CO2	2	1											
CO3		3	1	1									
CO4	2		1		1								
CO5	3	2	3	1	1								

This course consists of experimental and project-based learning.

- Part A: 5 weeks of experimental learning with 5 experiments. Students shall conduct the experiments individually. CIE for Part A shall be conducted in the 7th week.
- Part B: 5 weeks of project-based learning. A team of maximum 4 students shall carry out a project. The project shall be completed by the 13th week, CIE for Part B may be conducted in the 14th week.

Course Assessment and Evaluation: LAB (Ability Enhancement Course)

This course consists of experimental and project-based learning.

- Part A: 5 weeks of experimental learning with 5 experiments. Students shall conduct the experiments individually. CIE for Part A shall be conducted in the 7th week.
- Part B: 5 weeks of project-based learning. A team of maximum 4 students shall carry out a project. The project shall be completed by the 13th week, CIE for Part B may be conducted in the 14th week.

	Continuous Internal Evaluation (CIE): 50 Marks			
Sl.No.	**Components**	**Marks Conducted for**	**Marks Reduced to**	**40% Min Marks in each component to write SEE**

CIE for PART A(Experimental Learning)				
1	Periodic Lab Assessment	30	15	6
2	Lab CIE	20	10	4
	Total CIE for Part A	50	25	10
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10) and Viva(5M)-**Total 30M** **Lab CIE**: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M**)- Total 20M**				
CIE for PART B (Project based Learning)				
1	Lab CIE Part B	50	25	10
	Total CIE(Part A and Part B)	**100**	**50**	**20**
Rubric for Lab CIE Part B: Write-up (10M), Presentation(10M) Demonstration(20M) Viva(10M)- **Total 50 Marks**				
Semester End Examination(SEE) : 50 Marks, Duration: 3 Hrs **PART A (25 Marks):** **Rubrics for Part A:** Write-up(5M), Conduction/Execution/Demonstration(15M) and Viva(5M)-**Total 25M.** **PART B (25 Marks):** **Rubrics for Part B:** Write-up(5M), Presentation/Demonstration(15M) and Viva(5M)-**Total 25M.** **Minimum passing Marks: 40% in Part A and Part B each**				

Department: Humanities and Science			Semester:	IV
Subject: Constitution of India				
Subject Code:	25CI408	L – T – P - S:	14-0-0-16 (in Hrs)	
			Credits:	1

Sl. No	Course Objectives
1	To be familiar with salient features and preamble of the constitution of India, fundamental duties and rights
2	To understand the relevance of directive principles under part-4 and the responsibilities of individuals towards society.
3	To understand the powers and functions of the Legislature bodies.
4	To provide the information of FDs, Electoral Process, emergencies and amending procedures

Module	Description	Hrs
I	Introduction, Meaning and definitions. Salient features, Sources, Constituent Assembly, Drafting Committee. Preamble to the constitution of India.	2
II	Fundamental rights under part III, scope, Limitations and important cases, Judicial and Excecutive	2
III	Relevance of directive principles of state policy, fundamental duties and its significance, different commissions of india, Finance Commission, five year plans, 73rd & 74th Constitutional Amendment	3
IV	Union Executives- President, Vice President, Prime minister, Speaker, Parliament, Supreme Court of India. State Executives – Governor, Chief Minister, (Upper and lower house) State legislature and High Court.	3
V	Constitutional Special Provisions for Scheduled Castes and Tribes, Women, Children and backward classes. Electoral process. Ethics : Introduction Scope of Ethics , History of Ethics, Methods of Ethics Different Approaches to the Study of Ethics, Division of Ethics	4

Textbooks:

Sl No	Textbook title	Author	Volume and Year of Edition
1	Introduction to the	Durga Das	EEE, 19th/20th Edn.,2001

	Constitution of India (student edition)	Basu	
2	An Introduction to Constitution of India	MV Pylee	Volume-1 ,Vikas Publishing, 2002

Reference Books:

Sl. No.	Textbook title	Author	Volume and Year of Edition
1	An Introduction to Constitution of India	Brij kishore Sharma	Prentice-Hall of India, Volume-1, 2002
2	Constitution of India and Professional Ethics	V. Rajaram	Second Edition, New Age International Publication. 2011
3	https://egyankosh.ac.in/bitstream/123456789/81071/1/Block 1.pdf		

Course Outcomes:

Course outcome: After the successful completion of the course, the student will be able to	
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations
CO2	**Understand** the fundamental rights, directive principles and fundamental duties
CO3	**Understand** the importance of the three main organs of the constitution, Viz-legislature, executive and judiciary
CO4	**Remembe**r the various Amendments and Provisions
CO5	**Know** about various Union and state executives

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	1	3	3	2			
CO2		2			2				3	2	1		
CO3	1		1					3	2	2		1	
CO4				1				3	3	2			
CO5							1						

Course Assessment and Evaluation: Humanities and Social Science Courses (CIP, UHV, Environmental Science, Communicative English, Skill Development)

Sl.No.	Components		Duration(min)	Marks Conducted for	Min Marks To pass the Course
1	Theory-Internal Assessment	IA-1	90	50	40
		IA-2	90	50	
	Total CIE			100	40
IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module					

Department: Training and Placement			**Semester:**	**IV**
Subject: Fundamentals of Aptitude and Employability Skills				
Subject Code:	**25SK409**	**L – T – P - S:**	**14-0-0-16 (In Hrs)**	
			Credits:	**1**

Sl. No	**Course Objectives**
1	Develop fundamental quantitative aptitude skills required for problem-solving in placement assessments and competitive examinations.
2	Apply logical reasoning techniques to analyze patterns, relationships and solve reasoning problems systematically.
3	Enhance verbal communication and language proficiency through vocabulary development, comprehension and error analysis.
4	Demonstrate effective communication, professional ethics and employability skills required for career development and placement readiness.

Module	**Description**	**Hrs**
I	**Quantitative Aptitude Basics:** Number Systems, HCF and LCM, Percentages, Profit and Loss, Ratio and Proportion, Averages, Simple and Compound Interest, Time and Work, Time, Speed and Distance.	3
II	**Logical Reasoning Fundamentals:** Series Completion, Coding-Decoding, Blood Relations, Direction Sense, Ranking and Ordering, Puzzles, Seating Arrangements.	3
III	**Verbal Ability Basics:** Vocabulary Building, Synonyms and Antonyms, One-word Substitutions, Idioms and Phrases, Sentence Correction, Error Detection, Reading Comprehension Basics.	3
IV	**Communication Skills:** Fundamentals of Communication, Listening Skills, Public Speaking, Presentation Skills, Group Discussion Introduction, Confidence Building Activities.	3
V	**Employability Awareness:** Placement Process Overview, Career Planning, Industry Expectations, Professional Ethics.	2

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Quantitative Aptitude for Competitive Examinations	R. S. Aggarwal	Revised Edition, S. Chand, 2024
2	A Modern Approach to Verbal & Non-Verbal Reasoning	R. S. Aggarwal	Revised Edition, S. Chand, 2024
3	Soft Skills: Know Yourself and Know the World	Dr. Alex K.	3rd Edition, S. Chand, 2022

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	How to Prepare for Quantitative Aptitude for CAT	Arun Sharma	10th Edition, McGraw Hill, 2024
2	Word Power Made Easy	Norman Lewis	Revised Edition, 2023
3	Business Communication Today	Bovee, Thill & Chatterjee	15th Edition, Pearson, 2023

Course Outcomes:

Course outcome	Descriptions
CO1	**Illustrate** employability awareness, professional ethics and career planning strategies for placement preparedness.
CO2	**Solve** quantitative aptitude problems involving arithmetic, percentages, ratios, interests and work-related concepts.
CO3	**Demonstrate** proficiency in verbal ability through vocabulary usage, grammar correction and reading comprehension.
CO4	**Exhibit** effective communication skills through presentations, discussions and interpersonal interactions.
CO5	**Apply** logical reasoning techniques to analyze and solve analytical and pattern-based problems.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-	-
CO4	-	1	-	-	-	-	-	2	3	3	-	-	-
CO5	-	-	-	-	-	1	-	3	2	2	1	-	-

Course Assessment and Evaluation: Humanities and Social Science Courses (CIP, UHV, Environmental Science, Communicative English, Skill Development)

Sl.No.	Components		Duration(min)	Marks Conducted for	Min Marks To pass the Course
1	Theory-Internal Assessment	IA-1	90	50	40
		IA-2	90	50	
	Total CIE			100	40
IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module					

Department: Humanities and Science			Semester:	IV
Subject: Environmental Studies				
Subject Code:	25EN410	L – T – P - S:	14-0-0-16 (In Hrs)	
			Credits:	1

Sl. No.	Course Objectives
1	To identify the major challenges in environmental issues and evaluate possible solutions.
2	Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development.
3	To gain knowledge on different types of pollution in the environment.
4	To analyze an overall impact of specific issues and develop environmental management plan. Environment.

Module	Description	Hrs
I	Introduction: Environment - Components of Environment Ecosystem: Types of Ecosystem, Balanced ecosystem. Human Activities – Food, Shelter, And Economic & Social Security, Effects of human activities on environment-Agriculture, Housing, Industry, Mining & Transportation. Environmental Impact Assessment (EIA), Sustainable Development. **Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.**	3
II	Natural Resources-Introduction, types of resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water. Mineral resources, Forest Wealth. Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. **Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.**	3
III	Energy – Different types of energy, Conventional sources & Non-conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy. **Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.**	3

IV	Environmental Pollution – Air Pollution & Automobile Pollution Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management. **Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.**	**3**
V	Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs) , Environmental Education. **Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.**	**2**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Environmental Studies	Benny Joseph	Tata McGraw– Hill Publishing Company Limited(2005), Delhi.
2	Environmental Studies	R Rajagopalan	From Crisis to Cure", Oxford University Press, 2005

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Environmental Science and Engineering	Aloka Debi,	Universities Press (India) Pvt. Ltd. 2012
2	Environmental Studies	R.J.Ranjit Daniels and Jagadish Krishnaswamy,	Wiley India Private Ltd., New Delhi(2009),
3	Text Book of Environmental and Ecology"	Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya,	Acme Learning Pvt. Ltd. New Delhi

Course Outcomes:

Course outcome	Descriptions
CO1	**Understand** the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	**Develop** critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	**Demonstrate** ecology knowledge of a complex relationship between biotic and abiotic components.
CO4	**Apply** their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
CO5	**Understand** the major environmental issues and legal regulations.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1					2		3	3	3	1		
CO2	1					2		3	3	3	1		
CO3	1					2		3	3	3	1		
CO4	1					2		3	3	3	1		
CO5	1					2		3	3	3	1		

Course Assessment and Evaluation: Humanities and Social Science Courses (CIP, UHV, Environmental Science, Communicative English, Skill Development)

Sl.No.	Components		Duration(min)	Marks Conducted for	Min Marks To pass the Course
1	Theory-Internal Assessment	IA-1	90	50	40
		IA-2	90	50	
	Total CIE			100	40
IA-1 Syllabus: 2 ½ Module , IA-2 Syllabus: 2 ½ Module					