MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programme

Bachelor of Engineering

Department Of
COMPUTER SCIENCE AND BUSINESS SYSTEM

SCHEME and SYLLABUS

(2024 Admitted Batch)

Academic Year 2025-2026

MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

VISION OF THE INSTITUTE

To be an institute of excellence in engineering education and research, producing socially responsible professionals.

MISSION OF THE INSTITUTE

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional

VISION OF THE DEPARTMENT

Emerge as an industry focused centre for promoting innovation, entrepreneurship, research and best practices of computer science together with managerial skills to serve the society and industry.

MISSION OF THE DEPARTMENT

1. Impart globally connected cutting-edge technologies and business skills
2. Enhance industrial experience, promote entrepreneurship and research through industry institute interaction
3. Implement best practices to enrich knowledge and skill sets
4. Produce competent professionals with societal and environmental concern

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Explore and excel in emerging domains of computer science and business systems

PEO2: Develop professional skills that equip employability and higher education in the contemporary areas of Computer Science and Business Systems

PEO3: Empower Research Skills by designing and developing solutions in the field of IT and facilitate to take up higher studies

PEO4: Impart industry ready business skills through collaborations to bridge the gap between industry and academics

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).

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PROGRAM OUTCOMES (POs)

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 settings.

9. **Communication**: Communicate effectively and inclusively within the 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 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

PSO1: Develop efficient computer based systems to solve real life problems.

PSO2: Implement new generation technologies to design and develop industry relevant projects.

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Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE 1	**10**
CIE 2	**10**
CIE 3	**10**
Activities as decided by course faculty	**20**
SEE	**50**
Total	**100**

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous Evaluation in every lab session by the Course Coordinator	**10**
Record Writing	**20**
Laboratory CIE conducted by the Course Coordinator	**20**
SEE	**50**
Total	**100**

Examination	Maximum Marks	Minimum marks to qualify
CIE	50	20
SEE	50	20

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COURSE TYPES

Basic Science Course	BSC
Engineering Science Course	ESC
Emerging Technology Course	ETC
Programming Language Course	PLC
Professional Core Course	PCC
Integrated Professional Core Course	IPCC
Professional Core Course Laboratory	PCCL
Professional Elective Course	PEC
Open Elective Course	OEC
Project/Mini Project/Internship	PI
Humanities and Social Sciences, Management Course	HSMC
Ability Enhancement Course	AEC
Skill Enhancement Course	SEC
Universal Human Value Course	UHV
Non-credit Mandatory Course	MC

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Semester-wise Credit Distribution

Curricular Component / Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	8	8	3	4	-	-	-	-	**23**
Engineering Science Course (ESC)/ Emerging Technology Course (ETC)/Programming Language Course	9	9	3	2	-	-	-	-	**23**
Professional Core Course (PCC)	-	-	15	14	16	11	11	4	**71**
Professional Elective Course (PEC)	-	-	-	-	3	3	3	-	**9**
Open Elective Course (OEC)	-	-	-	-		3	3	-	**6**
Project/Mini Project/Internship (PI)	-	-	-	-		2	3	8	**13**
Humanities and Social Sciences, Management Course (HSMC)	1	2	-	-	1	-	-	-	**4**
Ability Enhancement Course (AEC)/ Skill Enhancement Course (SEC)	2	1	1	1	3	1	-	-	**9**
Universal Human Value Course (UHV)	-	-	1	1	-	-	-	-	**2**
Total Credits	**20**	**20**	**23**	**22**	**23**	**20**	**20**	**12**	**160**

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2024-2025 Admitted batch

THIRD SEMESTER												
Sl. No	**Course Category**	**Course Code**	**Course Title**	**Teaching & Learning (Hours per Semester)**					**Exam Marks**			**Credits**
				L	**T**	**P**	**TW + SL**	**Total**	**CIE**	**SEE**	**Total**	
1	BSC	24MACB301	Computational Statistics	2	1	0	34	90	50	50	100	3
2	PCC	24CB302	Operating Systems	3	0	0	48	90	50	50	100	3
3	IPCC	24CB303	Data Structures and its applications	3	0	2	64	120	50	50	100	4
4	PCC	24CB304	Business Economics	3	0	0	48	90	50	50	100	3
5	PCCL	24CB305	Digital Design and Practices	0	1	2	4	60	50	50	100	2
6	PCCL	24CB306	Unix and Shell Programming Laboratory	0	0	2	4	30	50	50	100	1
8	ESC	24CB307x	Engineering Science Course -I	3	0	0	48	90	50	50	100	3
9	AEC	24CB308x	Ability Enhancement Course-I	0	0	2	2	30	50	50	100	1
10	UHV	24SCR	Social Connect and Responsibility	0	0	2	2	30	100	-	100	1
11	MC	24NYP1	NSS, YOGA, PE	0	0	2	2	-	100	-	100	A
											Total	21

Engineering Science Course (ESC/ETC/PLC) - I	
Course Code	**Course Name**
24CB307A	Object Oriented Programming with Java
24CB307B	Object Oriented Programming with C++
24CB307C	Business Management
Ability Enhancement Course – I	
Course Code	**Course Name**
24CB308A	R Programming
24CB308B	Data Analytics with Excel
24CB308C	Data Visualization with Python
24CB308D	Version Controller with GiT

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FOURTH SEMESTER												
Sl. No	Course Category	Course Code	Course Title	Teaching Hours/Week					Exam Marks			Credits
				L	T	P	TW + SL	Total	CIE	SEE	Total	
1	BSC	24MACB401	Linear Algebra	2	1	0	34	90	50	50	100	3
2	PCC	24CB402	Theoretical Foundations of Computation	3	0	0	48	90	50	50	100	3
3	PCC	24CB403	Design and Analysis of Algorithms	3	0	2	50	120	50	50	100	4
4	IPCC	24CB404	Database Management Systems	3	0	2	50	120	50	50	100	4
5	PCCL	24CB405	WEB Programming	3	0	0	48	90	50	50	100	3
6	ESC	24CB406x	Engineering Science Course -II	3	0	0	48	90	50	50	100	3
7	AEC	24CB407x	Ability Enhancement Course - II	0	0	2	2	30	50	50	100	1
8	BSC	24BOK408	Biology for Engineers	0	1	0	2	30	50	50	100	1
9	UHV	24UHV	Universal Human Values	0	1	0	2	30	50	50	100	1
10	MC	24NYP2	NSS,YOGA,PE	0	0	2	2	-	100	-	100	A
Total												**23**

Engineering Science Course (ESC/ETC/PLC) - II	
Course Code	**Course Name**
24CB406A	Enterprise Resource Planning (ERP)
24CB406B	Business data analytics for Engineering
24CB406C	Entrepreneurship and Business Development
24CB406D	Graph Theory

Ability Enhancement Course – II	
Course Code	**Course Name**
24CB407A	Computer and Network Configuration
24CB407B	Power Bi
24CB407C	Technical writing using Latex

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Course Title	**COMPUTATIONAL STATISTICS**		
Course Code	**24MACB301**	**L-T-P-C**	**(2-1-0) 3**
Exam Hrs.	**3 Hours**	**Hours / Week**	**4**
SEE	**50 Marks**	**Total Hours**	**30L + 10T**

Course Objective: To equip students with a solid foundation in computational statistics, enabling them to analyze and interpret data, make informed decisions based on statistical evidence, and effectively communicate statistical findings.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate the fundamental statistical concepts, descriptive statistics, sampling estimation of point estimation and confidence intervals.	1,2	-
2.	Apply a range of statistical techniques including hypothesis testing, independence test, simple linear and logistic regression analysis to solve problems	1,2	-
3.	Analyze the given datasets using the appropriate statistical methods including multiple-regression analysis, analysis of variance to draw meaningful conclusions, and effectively communicate the results of their analyses	1,2,3	-
4.	Interpret the probability distribution and give the statistical output and also, predict the probability in the long run for Markov chain based problems.	1,2	-

Course Contents:

Module 1 — **8 Hours**

Introduction to Statistical Concepts:

Introduction to Statistics: Definition and importance of statistics, Types of data and variables, Descriptive Statistics, Measures of central tendency (mean, median, and mode) Measures of variability (range, variance, and standard deviation). Probability distributions (discrete and continuous): mean, variance and standard deviation. Exponential distribution, Uniform distribution, Normal distribution.

Applications: Current measurement problems

Self-study: Data visualization techniques (histograms, boxplots).

Module 2 — **8 Hours**

Joint Probability Distribution: Joint distributions of discrete random variables-Marginal probability distribution, Independent random variables, expectation, co-variance, and correlation.

Markov Chains: Regular stochastic matrices, transition probability matrix, transition-probability matrix, higher transition-probabilities, stationary distribution of regular Markov chains and irreducible Markov chain.

Applications: Application of Markov chain to determine the voting tendencies.

Self-study: Estimating the population distribution of a city due to migration.

Module 3 — **7 Hours**

Statistical Inference

Sampling and Estimation: Sampling methods and techniques, Point estimation and confidence intervals, Sample size determination.

Hypothesis Testing: Introduction to hypothesis testing- Null and alternative hypotheses, Type I and Type II errors, significance level, and p-values. Parametric Tests: One-sample and two-sample-z-tests, t-tests. Chi-square test for independence of test.

Applications: Propellant burning rate, process-capacity problem, drying time problem	
Module 4	**7 Hours**
Statistical Models and Analysis Introduction to Regression Analysis- Simple linear regression: Assumptions and interpretation. Coefficient of determination (R-squared). Multiple Regression Analysis: Multiple linear regression. Logistic regression, Odds ratio and interpretation. **Analysis of Variance (ANOVA):** One-way ANOVA and two-way ANOVA. **Self-study:** Model assumptions and diagnostics, Variable selection techniques (stepwise, backward, forward), Analysis of Categorical Data	

Note–Theorems and properties without proof. Applicable to all the modules.
Self-study is not included in SEE

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Statistics	S C Gupta	7th ISBN-10:9350517698	Himalaya Publishing House	
2.	Statistics for Business: Decision Making and Analysis	Robert Stine	2nd ISBN-9780136759102	Pearson	2017
3.	Probability, Statistics and Random Process	T Veerarajan	3rd	Tata McGraw Hill Co.	2008

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani.			
2.	Statistical Computing with R	Maria L. Rizzo. 2nd edition, Chapman and Hall/CRC		Tailor and Francis Group	2019
3.	Bayesian Data Analysis	Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin.			
4.	Numerical Recipes: The Art of Scientific Computing	William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery			

EBooks and online course materials:

1. https://www.coursera.org/learn/the-power-of-statistics
2. https://nptel.ac.in/courses/110107114

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/stanford-statistics
2. https://www.coursera.org/learn/machine-learning-probability-and-statistics
3. https://onlinecourses.nptel.ac.in/noc21_ma74

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
3	Activity Based Learning(ABL1&ABL2)	-	-	27
4	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan(for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Details of activity 1 2. Details of activity 2	20
Total		**50**

Activity Based Learning (27Hours)

ABL1(14 Hours) :Activity 1 details		**Hours**
Writing Assignment with Problems	Submission of the final assignment report	14

on concerned to real world applications.	and evaluation.(Questions of Blooms level L3 and Higher)	
Total		**14**
ABL2(13Hours):Activity 2 details		
Problem Solving Assignment	Understand the input data requirements	1
	Formulate the methodology	4
	Design the solution	4
	Solving the problem and submission	4
Total		**13**

Evaluation of Learning Process (7Hours)

Type of Evaluation	**Hours**
Test(1,2and3)	3
Activity(1and2)	1
Semester End Exam	3
Total	**7**

Course Outcomes	**Program Outcomes [POs]**													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-

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Course Title	**OPERATING SYSTEMS**		
Course Code	**24CB302**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Students will be able to explore the working mechanism of operating systems.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**POs**	**PSOs**
1.	Describe the fundamentals of operating systems structure	1	-
2.	Explore various scheduling and ssynchronization techniques	2	-
3.	Implement suitable techniques to solve deadlock	3	2
4.	Apply memory management techniques for efficient memory management	3,4	2

Course Contents:

Module 1	**10 Hours**

Introduction to Operating Systems and System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system.
Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation;

Module 2	**10 Hours**

Operating System structure Virtual machines**. Process Management**: Process concept; Process scheduling; Operations on processes; Inter- process communication,
Threads: Overview; Multithreading models; Threading issues. **Process Scheduling:** Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling;

Module 3	**10 Hours**

Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization.
Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Module 4	**10 Hours**

Memory Management: Main Memory: Background; Swapping; Contiguous memory allocation; Paging; Segmentation. **Virtual Memory Management:** Background; Demand paging; Page replacement. **Mass-Storage Structures:** Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management.

Self Study: Case Study Applications – OS architecture comparison (Linux, Windows), shell interface, resource allocation scenarios

Prescribed Textbooks:

Sl. No	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1.	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	8th Edition	John Wiley & Son	2012

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Operating systems - A concept based Approach	D.M. Dhamdhere	3rd Edition	Tata McGraw-Hill	2006
2.	Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	2nd Edition	PHI	2008
3.	Operating Systems Internals and Design Principles	William Stallings	8th Edition	Tata McGraw-Hill Education	2007

MOOCs: Fundamentals of Operating System https://nptel.ac.in/courses/106/105/106105214/

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	2
CO4	-	-	3	2	-	-	-	-	-	-	-	-	2

Teaching - Learning – Evaluation Scheme

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**18+9 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL 1 – Case Study & SRS Document Preparation (18 hrs)	**Hours**
1. Selection of a real-time OS problem (e.g., multi-user deadlock) 2. Literature review + Problem statement (3 hrs) 3. Meetings with faculty to finalize topic (2 hrs) 4. UML diagrams (Use Case, Activity, DFD, Sequence) and report (12 hrs) 5. Final report submission and presentation (1 hr)	18
Total	**18**
ABL 2 – Simulation-Based Assignment (9 hrs)	

1. Implement simulation models (e.g., Round Robin scheduler) 2. Implement simulation models (e.g., Round Robin scheduler) 3. Submission with code and demo 4. Submission with code and demo 5. Evaluation based on performance metrics and viva	09

Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Presentation and Viva	1
Semester End Exam	3
Total	**7**

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Course Title	**DATA STRUCTURES AND ITS APPLICATIONS**		
Course Code	**24CB303**	**L-T-P-C**	**(3-0-2) 4**
Exam Hrs.	**3**	**Hours / Week**	**5**
SEE	**50 Marks**	**Total Hours**	**40L+14P**

Course Objective: Students will be able to implement appropriate data structures for solving problems.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the various types of Data Structures	1	-
2.	Implement operations of linear and non-linear data structure	2	-
3.	Apply suitable data structures to solve a problem	2,3	-
4.	Develop programs using linear and non-linear data structures for a given scenario.	2,3	2

Course Contents:

Module 1	**13 Hours**

Introduction: Structures and pointers revisited. Introduction to data structures - Basic terminology, Classification, Operations.

The Stack -Definition, Operations, Array Representation of stacks in C Applications of stack: Infix, postfix and prefix, Basic definitions and examples, evaluating a postfix expression, Program to evaluate a postfix expression, converting an expression from infix to postfix, Program in C to convert an expression from infix to postfix.

Module 2	**13 Hours**

Recursion - Finding GCD, Fibonacci Series, Recursion Types, Tower of Hanoi, and Recursion versus iteration. **Queues** - Definition, Array representation of Queues, Operations on Queues, Types of Queues- Circular Queue and its implementation in C, Applications of Queues. **Linked List**: Introduction to linked list, linked list versus arrays, singly linked list operations - Insert, Delete, Display, Search and Traverse.

Module 3	**13 Hours**

Other **Lists structures**: Circular Lists - C Implementation by adding and deleting nodes, Doubly Linked List - C implementation by adding and deleting nodes, Circular doubly linked list, Linked list Applications: Linked Implementation of stacks and Queues, Polynomial Representation.

Module 4	**13 Hours**

Trees: Basic Terminology, Types, Representation using array and Linked List. Creating a binary tree from a general tree, traversing a binary tree- In-order, Pre-order, Post order, Level order, Constructing a binary tree from traversal results. **Efficient Binary Trees**: Binary Search trees - definition, Operations- Create, Insert, delete, display, finding height, Finding number of nodes. AVL trees - Definition, Rotations, Constructing an AVL tree.

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Self -Study Components:
Implementation of data structures in real-life applications: compiler design, memory management, file system, browser history

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Data Structures Using C	Reema Thareja	Second edition	Oxford Press	2017

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Data Structures Using C and C++	Yedidyah, Augenstein, Tannenbaum	2nd Edition	Pearson Education	2003
2.	Data Structures A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzan		Cengage Learning	2005
3.	Classic Data Structures	Debasis Samanta	2nd Edition	PHI	2009
4	Balagurusamy E	Programming in ANSI C	7th Edition	Tata McGraw Hill	2017

MOOCs:
1. http://nptel.ac.in/keyword_search_result.php?word=data+structures

Lab Integrated Programs
1. Write a C program to find the maximum and minimum element in an array of n integers. Use only pointers for referencing the array. 2. Write a C program for Dynamic Memory allocation of 10 elements and find the largest element. 3. Write a C program to represent a complex number using structure variable. Write user defined functions that accept two complex numbers and finds their sum and difference. 4. Define a structure Author name with fields: First name, Middle name and Last name. Using the above structure, design another structure Book:ISBN, Author name, Book Title, Price, Publisher, and Edition. Write a function to search a book given the Author name. Using the above function write a C Program to store N books information and display the details of a book given the author name
Exercise Programs

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1. Files are placed one over another in my study room. The file which is at the top is the first one to be removed, i.e. the file which has been placed at the bottom most position remains in the pile of files for the longest period of time. Help me out to add a file and remove the bottom most file from the pile of files.
2. Consider an algebraic expression which needs to be evaluated by a computer system. Operating System (OS) consumes less time to evaluate if it is in postfix form of the expression. Thus, help your OS to evaluate by converting the expression into its postfix form.
3. Assume you have converted an algebraic expression into its postfix form to process the expression fast. This expression need to be evaluated for a given set of values. Implement the above.
4. Assume you come across a toll gate while you are on your way to home town. Illustrate the working of the toll gate using suitable data structure
5. a) Suppose you want to search a text book in a huge library where books are arranged in alphabetical order. Optimize your search by using recursion. b) Implement Tower of Hanoi problem using recursion.
6. Consider a traffic signal controlled by a computer system. Traffic signal has three colors: Red, yellow and Green. All these glow in a circular fashion based on the traffic. Implement the above using suitable data structure.
7. The parking lot has a fixed number of parking spaces. Cars can enter the parking lot and occupy an available space, and they can also exit the parking lot, freeing up the space for other cars. Designing a parking lot management system using a circular queue.
8. Consider a treasure hunt task where a series of clues are given. Clue1 gives hint to clue2, clue2 Provides hint for clue3 and so on until you can get a hint to the final treasure. Develop an illustration to demonstrate the above scenario.
9. Consider a list of numbers. Find i. Maximum number ii. Minimum number iii. Sum of all the numbers
10. The phonebook will contain a list of contacts sorted in ascending order based on their names. Each contact will have a name and a phone number. Developing a phonebook management system using an ordered linked list.
11. Assume you have an iPod, where in you have stored plenty of songs so that you get engaged during a long journey. If you want to hear a particular song, you need to use forward button to reach that song and can also traverse back using backward button. Implement the following using relevant data structure.
12. Your text book contains chapters, sections, subsections, subdivisions, etc. Illustrate this scenario of text book using tree structure.

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	3	-	-	-	-	-	-	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**2**	**14**	**28**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**08**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**14+14 = 28**
			Total Learning Hours/Semester	**120**

Activity Based Learning (43 Hours)

ABL	Hours
ABL 1 – Case Study & SRS Document Preparation (14 hrs) 1. Selection of a real-world application scenario (e.g., expression evaluator, parking system, library management) 2. Literature review + problem definition and scope finalization (2 hrs) 3. Meeting with faculty to finalize the case and modules (1 hrs) 4. UML modeling: Use Case, Activity, DFD-0 & DFD-1, Sequence Diagrams with data structure mapping (10 hrs) **5.** Final SRS report submission and group presentation (1 hrs)	14
ABL 2 – Problem-Solving Based Assignment (14 hrs) 1. Implement real-world data structure solutions (e.g., postfix evaluator using stack, polynomial addition using linked list, AVL tree simulation) **2.** Submission of code, output snapshots, and report Evaluation based on functionality, complexity analysis, and viva presentation	14
Total Learning Hours/Semester	**28**

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Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Lab CIE and Viva	2
Semester End Exam	3
Total	**8**

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DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

Course Title	**BUSINESS ECONOMICS**		
Course Code	**24CB304**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective. Students will be able to apply various economic principles to analyze and interpret market behaviour in real-world contexts.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Evaluate the fundamentals of engineering economics, demand-supply laws, cost elements, and breakeven analysis.	6,10	-
2.	Apply interest formulas and perform present worth, future worth, and payback comparisons for engineering decisions.	2,10	1
3.	Evaluate alternatives using annual worth methods, depreciation techniques, and taxation concepts.	2,10	1
4.	Analyze costing systems and perform cost-volume-profit analysis and budgeting in both industrial and service sectors.	6,10	-

Course Contents:

Module 1	**10 Hours**

Introduction: Engineering decision – makers, Engineering and Economics, Problem solving and decision making, Intuition and Analysis, Tactics and Strategy, Engineering economic decision maze, Law of demand and supply, Law of returns, Elements of Costs, other costs/revenues, breakeven analysis with numerical, Profit/Volume Ratio (P/V ratio) with numerical.

Elementary Economic Analysis: Introduction, simple economic analysis, material selection, design selection, building selection, Process planning/process modifications.

Module 2	**10 Hours**

Interest and Interest Factors: Interest rate, Simple interest, Compound interest, Cash –flow diagrams, Exercises and discussion.

Present worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons. Present worth equivalence, Net present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay-back comparison, Exercises, Discussions and problems.

Module 3	**10 Hours**

Equivalent Annual Worth Comparisons: Equivalent annual worth comparison methods, Situations for equivalent annual worth comparisons. Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises and Problems.

Present-Worth Comparisons: Cash flow diagram, Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Numerical problems.

Module 4	**10 Hours**

Depreciation and Taxation: Depreciation meaning, Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, GST, Inflation: Causes, Consequences and Control of Inflation, Inflation in Economic Analysis.

Costing Systems: Elements of Cost, Cost Behavior, Cost Allocation, OH Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis, Application of costing concepts in the Service Sector.
Self-Study Components: Impact of Inflation on Engineering Costs, GST in Engineering Procurement, Break-Even Analysis of a Real-World Product, Depreciation Methods in Financial Reports, NPV and EAW Using Online Tools

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Economics	R. Panneerselvam	Latest	PHI	2015
2	Principles of Economics	N. Gregory Mankiw	Latest	Cengage Learning	2023

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Microeconomics	Pindyck & Rubinfeld	Latest	Pearson	2022
2	Modern Economics	H.L. Ahuja	Latest	S. Chand	2022

E Books and online course materials:

1. https://books.google.com/books/about/Managerial_Economics_8th_Edition.html?id=H7FDDAAAQBAJ
2. https://www.cengage.com/c/principles-of-economics-10e-mankiw/9780357722718/

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/110105067/
2. https://www.coursera.org/learn/principles-of-economics

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Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	2	-	-	-	3	-	-	-
CO2	-	3	-	-	-	-	-	-	-	2	-	2	-
CO3	-	3	-	-	-	-	-	-	-	3	-	2	-
CO4	-	-	-	-	-	2	-	-	-	3	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Case Study & Financial Modeling Assignment (15 Hours) 1. Prepare a break-even chart for a small business scenario and analyze P/V ratio impact with cost variations. 2. Create a cash flow diagram and perform present worth analysis to compare two equipment purchase options. 3. Compare two real-world investment options (e.g., machines) using EAW and shrinking fund method; present justification. 4. Prepare a multi-method depreciation schedule for an asset and simulate impact of inflation and GST on costing.	**15**
ABL 2 – Simulation & Cost-Based Decision Assignment (12 Hours) 1. Select a decision scenario (e.g., lease vs buy, replacement vs repair) 2. Create models using Present Worth or Annual Worth 3. Submit analysis with code/spreadsheet + output 4. Present findings with justification	**12**
Total Learning Hours/Semester	**27 hours**

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Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Presentation and Viva	1
Semester End Exam	3
Total	**7**

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DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

Course Title	**DIGITAL DESIGN AND PRACTICES**		
Course Code	**24CB305**	**L-T-P-C**	**(0-1-2) 2**
Exam Hrs.	**3**	**Hours / Week**	**4**
SEE	**50 Marks**	**Total Hours**	**26+26 = 52**

Course Objective: Students will be able to design and implement various analog and digital circuits.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate logic circuits using Digital Trainer Kit and analog circuits.	1,2	-
2.	Design and demonstrate various combinational logic circuits, counters and registers using flip flops.	1,2,3	1
3.	Implement and document the designed digital and analog circuits	3,4,5	2

Course Contents:

Module 1	8 Hours
Digital Logic: Introduction, The Basic Gates, The Universal Gates, Sum-of-Products Method, Truth Table to Karnaugh Map, Conversions of Number to Binary, Octal, Hex, XOR gate	

Module 2	6 Hours
Data-Processing Circuits: Multiplexers, Decoders, Half Adder and full adder **Flip-Flops**: Types of Flip Flops, RS flip flop, D Flipflop, JS Flipflop, T Flipflop, Gated Flip Flop, Edge triggered for flip-flops, various Representation of FLIP-FLOPs.	

Module 3	6 Hours
Registers: Types of Registers Counters: Counter Design as a Synthesis problem, Asynchronous and Synchronous Counters**. Direct Memory Access**: Bus Arbitration. The Memory System: Basic Concepts, Cache Memories: Mapping functions	

Module 4	6 Hours
Performance considerations: Interleaving, Hit Rate & Miss Penalty. Arithmetic: Multiplication of Positive numbers: Signed-Operand Multiplication: Booth Algorithm, IEEE Standard for Floating-Point Numbers. **Data Organization:** Memory Locations and Addresses: Byte addressability, Big-endian & Little-endian assignments.	

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Design and Implement the following Practical Components (26 Hrs)

1. In a battery powered computer, the diskette driver motor 1 should be ON iff
   a. There is a diskette in the drive.
   b. The diskette drive door is closed.
   c. Diskette drive motor 2 is not ON.
   d. The battery low signal is not present and
   e. The computer has started a read operation, or the computer has started a write operation.

   Design a circuit to solve the above scenario using basic gates.

2. You will gain weight if you eat too much or you do not exercise enough, and your metabolism rate is too low. Design a system such that it alarms you when you gain weight using NAND gates.

3. The circuit breaker will trip iff
   a. The hair drier is turned ON.
   b. The microwave oven is used.
   c. All the lights in the room are ON or
   d. There is a short circuit in any appliance.
   Solve the above issue using relevant MUX.

4. In an automated house, two lamps L1 and L2 are controlled by 3 switches: A, B, C. Any one of the lamps should be ON, following the below conditions.
   a. L1 is ON if switch A and B are open but not C.
   b. L1 is ON if switch B and C are open but not A.
   c. L2 is ON if only switch C is open.
   d. L2 is ON if only switch B is open.
   e. L2 is ON if switch A or C is open, but not B.

   Design a circuit to make the lamp ON using decoder.

5. Assume you need to send a secret message consisting of numbers from 1 to 9 and letters from A to F. Secret message is encoded using excess 3 code. Design a circuit using ADDER IC to send a secret message to your friend.

6. Assume you are generating and transmitting binary data from one place to another. Check whether sent data is transmitted properly or not.

7. Consider a computer operator who needs to generate a sequence 1011 continuously which is transmitted across the network. Design a circuit to implement this job.

8. Consider a scenario where in you want to take print out of few selected random pages in sequence numbered from 0 to 15. Design a circuit to achieve this task using J-K Flip-flops.

9. Design and implement a 3-stage up/down counter that counts from a present value using Decade pre-settable counter ICs. Display the result suitably.

10. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

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Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Digital Principles and Applications	Donald P Leach, Albert Paul Malvino & Goutam Saha	8th Edition	Tata McGraw Hill	2015
2	Computer Organization	Carl Hamacher, Z. Vranesic & S. Zaky	5th Edition	McGraw Hill	2016

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Computer Organization and Architecture	William Stallings	9th Edition	Pearson India	2013
2	Digital Logic and Computer Design	M Morris Mano	1stEdition	Pearson	2013

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	2	-
CO3	-	-	2	2	3	-	-	-	-	-	-	-	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	2	14	28
2.	Lab Component	2	14	28
4.	Evaluation of Learning Process			4
Total Learning Hours/Semester				**60**

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

Course Title	**UNIX AND SHELL PROGRAMMING LABORATORY**		
Course Code	**24CB306**	**L-T-P-C**	**(0-0-2) 1**
Exam Hrs.	**3**	**Hours / Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: Providing a comprehensive introduction to UNIX commands and utilities, students will develop Shell Programming and Vi editing skills.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply critical thinking and problem-solving skills to design efficient shell scripts using UNIX commands and utilities for accomplishing specific tasks.	1,2,5	1
2.	Develop skills to produce comprehensive and clear documentation of the scripts.	2,3	-

Course Contents:

Execution following basic UNIX commands

ls, ls –l, cat, grep, sed, cd, od, mkdir, echo, date, mv.

Design and Develop a shell scripts for following statements

- Write a shell script that takes a valid directory name as an argument and recursively descend all the sub-directories, finds the maximum length of any file in that hierarchy and writes this Maximum value to the standard output.
- Write a shell script that accepts a path name and creates all the components in that path name as directories. For example, if the script is named mpc, then the command mpc a/b/c/d should create directories a, a/b, a/b/c, a/b/c/d.
- 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, output common permissions and otherwise output each file name followed by its permissions.
- Create a script file called file-properties that reads a file name entered and outputs it properties.
- Write a shell script that accepts one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory
- Write a shell script that accepts as filename as argument and display its creation time if file exist and if it does not send output error message.
- Write a shell script that gets executed displays the message either “Good Morning” or “Good Afternoon” or “Good Evening” depending upon time at which the user logs in.
- Write a shell script that accept the file name, starting and ending line number as an argument and display all the lines between the given line number.

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	-	2	-	-	-	-	-	-	2	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Lab conduction	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**02**
Total Learning Hours/Semester				**30**

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Engineering Science Course - I

Course Title	**OBJECT ORIENTED PROGRAMMING WITH JAVA**		
Course Code	**24CB307A**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Design and develop java application programs using object-oriented concepts.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Describe the fundamentals of Object Oriented Programming and Java syntax	1	-
2.	Implement the concepts of Object Oriented Programming to design programs	2,3	-
3.	Apply Interfaces to design programs	3,4	2
4.	Handle Exceptions in Java	5	2

Course Contents:

Module 1	**10 Hours**

Java Programming Fundamentals: Java and Java Applications, Java Development Kit (JDK), The Byte Code, The Java Buzzwords, A first Simple program, handling syntax errors, The Java Keywords, Identifiers in Java.

Data Types and Operators: Java's Primitive Types, A Closer Look at Variables, The Scope and Lifetime of Variables, Operators: Arithmetic, Bitwise, Relational, Boolean Logical, Assignment Operators, the '?' Operator, Type conversion and Casting, Arrays, Strings.

Object Oriented Concepts and Java: Concepts of Object-Oriented programming language: Object, Class, Message passing, inheritance, encapsulation, and polymorphism Difference between OOP and other conventional programming – advantages and disadvantages of OOPS.

Module 2	**10 Hours**

Introducing Classes, Objects and Methods: Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, the "This" keyword, Garbage collection, Overloading Methods and constructors, Argument Passing, Returning Objects, Access Control, Understanding Static, Nested and Inner Classes.

Program Control Statements: Input characters from the Keyboard, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Nested Loops, Use of break and continue.

Module 3	**10 Hours**

Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors and inheritance, Using super to C all Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why overridden Methods, Using Abstract Classes, Using final, The object class.

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Module 4	10 Hours
Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Implementing Multiple Interfaces, Interfaces can be extended, Nested Interfaces. Packages: Package Fundamentals, Packages and Member Access, Importing Packages, Static import. **Exception Handling**: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, throw, finally, Java's Built-in Exceptions, Customized exceptions.	

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Java Fundamentals, A comprehensive Introduction	Herbert Schildt, Dale Skrien. Tata McGraw Hill	7th		2013
2	Java –The complete Reference	Herbert Schildt	8th	Tata McGraw Hill Education Pvt.Ltd	

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Programming in JAVA2	Dr K Somasundaram		Jaico publications	
2	Java How to Program	Deitel and Deitel	6^{th}	Pearson	
3	Java Programming	Hari Mohan Pandey		Pearson Education	2012

E Books and online course materials:

1. http://nptel.ac.in/courses/106106147/
2. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
3. https://www.youtube.com/watch?v=0KL_zftem4g
4. https://www.coursera.org/specializations/object-oriented-programming

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-	2
CO4	-	-	-	-	3	-	-	-	-	-	-	-	2

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Mini Project: OOP Design & Implementation *(15 Hours)* Create a Java application implementing classes, inheritance, interfaces, and exception handling. **Steps:** 1. Project topic finalization (e.g., Library Management System, Online Quiz, Student Report Generator) – 2 hrs 2. Class, inheritance & interface design – 4 hrs 3. Code development – 5 hrs 4. Exception handling and final testing – 2 hrs 5. Report writing and demo presentation – 2 hrs	**15**
ABL 2 – Code Lab Challenges (12 Hours) Problem-solving challenges based on: • Inheritance and polymorphism • Nested loops with logic building • Exception handling practice sets • Submit and demo code to faculty	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3) Details of activity 1 4) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

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Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Report Valuation and Presentation	1
Semester End Exam	3
Total	**7**

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Course Title	**OBJECT ORIENTED PROGRAMMING WITH C++**		
Course Code	**24CB307B**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: This course introduces object-oriented programming in C++ to develop modular, reusable applications using classes, inheritance, polymorphism, and exception handling.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Interpret the core concepts of object-oriented programming and features of C++.	1,2	-
2.	Apply class structures, constructors, and member functions to create modular code.	2,3	1
3.	Analyze and implement inheritance, polymorphism, and operator overloading.	2,4	1
4.	Evaluate template-based and exception-handled solutions for general-purpose programming.	3,4	-

Course Contents:

Module 1	**10 Hours**
Introduction to Object Oriented Programming: A Look at Procedure-Oriented Programming, Object-Oriented Programming Paradigm, Basic Concepts of Objet-Oriented Programming, Benefits of OOP, Object-Oriented Languages, Applications of OOP. A Simple C++ Program, More C++ Statements, Structure of C++ Program, An Example with Class, Tokens, Keywords, Identifiers and constants, Reference Variables, Operators in C++, Scope resolution operator, Expressions and their types– Special assignment expressions.	
Module 2	**10 Hours**
Functions in C++: Function prototyping, Call by reference, Return by reference, Inline functions, Default arguments, Function overloading**. Classes and Objects**: Specifying a Class, Defining Member Functions, A C++ Program with Class, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions, Returning Objects, Constructors, Parameterized Constructors, Multiple Constructors in a class, Copy Constructor, Destructors.	
Module 3	**10 Hours**
Operator Overloading: Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators - Overloading Binary Operators using Friend function – Manipulation of strings using Operators – Rules for Overloading Operators. **Inheritance**: Derived class Constructors, destructors, Types of Inheritance, Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance	
Module 4	**10 Hours**
Templates: Class Templates – Class Templates with Multiple Parameters, Function templates, Function Templates with Multiple Parameters, Overloading of Template functions, Member Function Templates. **Exception Handling**: Introduction to Exception, Benefits of Exception handling, Try and catch block Throw statement, Pre-defined exceptions in C++	

Prescribed Textbooks:

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Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Object Oriented Programming with C++	E. Balagurusamy	8th	McGraw Hill Education	2020
2	Programming with ANSI C++	Bhushan Trivedi	2nd	Oxford University Press	2012

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Object-Oriented Programming in C++	Robert Lafore	4th	Galgotia Publications	2012
2	The Complete Reference C++	Herbert Schildt	4th	Tata McGraw Hill	2012

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	2	-	-	-	-	-	-	-	2	-
CO4	-	-	3	2	-	-	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours

ABL 1 – Mini Project: OOP Design & Implementation (15 Hours) Create a C++ application implementing classes, inheritance, interfaces, and exception handling. **Steps:** 1. Project topic finalization (e.g., Library Management System, Online Quiz, Student Report Generator) – 2 hrs 2. Class, inheritance & interface design – 4 hrs 3. Code development – 5 hrs 4. Exception handling and final testing – 2 hrs 5. Report writing and demo presentation – 2 hrs	**15**
ABL 2 – Code Lab Challenges (12 Hours) Problem-solving challenges based on: • Inheritance and polymorphism • Nested loops with logic building • Exception handling practice sets Submit and demo code to faculty	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Code Demonstration and Report Valuation	1
Semester End Exam	3
Total	**7**

Course Title	**BUISNESS MANAGEMENT**		
Course Code	**24CB307C**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**

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SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Describe company's role in society, business cultures, and management—from concept to operations—using strategic planning, objectives, and control.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the importance of management for coordinating the industrial activities and to use the scientific management principles for effective utilization of resources	6,11	-
2.	Effectively plan, coordinate, control, lead and communicate for smooth functioning of the organization	10,11	-
3.	Illustrate the different categories of enterprise, organizational structure, responsibilities and authorities in an organization	6	-
4.	Implement international managerial functions in the Indian context and to take-up higher education	6,11	2

Course Contents:

Module 1	**10 Hours**

Management, Science, Theory and Practice: Definition of Management, its nature and purpose, managerial skills and organizational hierarchy, Managing- Science or Art? Contributions of F.W. Taylor and Henry Fayol, Functions of managers, levels of management, Management and Society: Social responsibility of managers, Ethics of managing.

Ownership of Enterprises: Proprietorship, Partnership, types, Joint stock Companies - Private and Public limited companies public sector companies, Co-operative organizations, types, methods of raising capital.

Module 2	**10 Hours**

Planning: Definition of planning, Types of plans, steps in planning, MBO, how to Set Objectives, Benefits and weakness of MBO Some Recommendations.

Strategies, Policies and Planning Premises: Nature and Purpose of Strategies and Policies, TOWS matrix: A modern tool for analysis of the situation, Major kinds of strategies and policies.

Decision Making: Importance and limitations of rational decision making, Rationality in decision making, Evaluation of alternatives, selecting an alternative- three approaches, Programmed and Non-programmed decisions.

Module 3	**10 Hours**

Organizing: The nature and purpose of organizing, Formal and informal organization. Organization levels and Span of management, a system approach to organization, principles of organization, principles of organization, Types of organization: line, military or scalar, functional, project/product/departmentation, matrix/grid.

Staffing: Definition of Staffing, Systems approach to human resources, Situational factors affecting staffing. Selection- matching the person with the job, Skills and personal characteristics needed by managers, Selection process, Techniques and instruments, purpose of Performance appraisal.

Module 4	**10 Hours**

Leading: Human factors in managing, , Motivations and motivators. Maslows Hierarchy of needs Theory, Herzberz motivation- Hygine theory, mcgregors theory X and theory Y , Leadership: Leadership behavior and Leadership styles,

Communication: Importance of Communication, Purpose of Communication, Communication process, Types of communication, Effective communication.

International Management: Managerial functions in international business, Japanese management

and Theory Z.

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Principles of Management	Harold Koontz, H. Weihrich, A.R. Aryasri		Tata McGraw-Hill, New Delhi	
2	Industrial Engineering and Management	OP Khanna, Dhanpat Rai and Sons			

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Essentials of Management	Harold Koontz, H. Weihrich		Tata McGraw-Hill, New Delhi	
2	Management of Organizational Behaviour	Hershey Paul and Kenneth Blanchard		PHI	

MOOCs:

- https://onlinecourses.nptel.ac.in/noc23_mg33/preview

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	2	-	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (ABL) (27 Hours)

ABL	Hours
ABL 1 – Organization Case Study & Structure Mapping (15 Hours) 1. Selection of a real-world company or simulation of a hypothetical organization 2. Literature review and management structure breakdown – 3 hrs 3. Mapping organizational hierarchy, leadership style, and departmental structure – 5 hrs 4. Evaluation of staffing, decision-making methods, and communication models – 5 hrs 5. Report submission and team presentation – 2 hrs	**15**
ABL 2 – Scenario-Based Planning & Managerial Role Play (12 Hours) • Create a strategic business plan using MBO and TOWS for a mid-sized business – 4 hrs • Perform leadership-based role plays (Theory X, Theory Y, Theory Z) – 4 hrs • Simulate communication models and conflict resolution techniques – 2 hrs • Reflection write-up and evaluation of group performance – 2 hrs	**12**
Total Learning Hours/Semester	**27 hrs**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	3
Report Valuation and Presentation	1
Semester End Exam	3
Total	**7**

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Ability Enhancement Course-I

Course Title	**R PROGRAMMING**		
Course Code	**24CB308A**	**L-T-P-C**	**(0-0-2) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**
Course Objective: To learn and Practice Programming techniques using R Programming. **Course Outcomes (COs):** Upon completion of the course, students shall be able to:			
No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Prepare the dataset in suitable format with required preprocessing.	1	1

2.	Apply suitable Programming Constructs and Data Structures in program.	2,3,5	-
3	Use visualization packages and file handlers for data analysis.	1,2	-

Practice Programs:

1. Installation of R Studio
2. Write an R Program to take input from the user (name and age) and display the values. Also print the version of R installation.
3. Write an R Program to get the details of the objects in memory.
4. Write an R Program to create a sequence of numbers from 20 to 50 and find the mean and product of numbers from 20 to 60 and sum of numbers from 51 to 91.
5. Write an R Program to multiply two vectors of integer's type and length 3.

Guided Laboratory Experiments

1. Demonstrate the steps for installation of R and R Studio. Perform the following:
   a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.
   b) Demonstrate Arithmetic and Logical Operations with simple examples.
   c) Demonstrate generation of sequences and creation of vectors.
   d) Demonstrate Creation of Matrices
   e) Demonstrate the Creation of Matrices from Vectors using Binding Function.
   f) Demonstrate element extraction from vectors, matrices and arrays
2. Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:
   a. Profit for each month.
   b. Profit after tax for each month (Tax Rate is 30%).
   c. Profit margin for each month equals to profit after tax divided by revenue.
   d. Good Months – where the profit after tax was greater than the mean for the year.
   e. Bad Months – where the profit after tax was less than the mean for the year.
   f. The best month – where the profit after tax was max for the year.
   g. The worst month – where the profit after tax was min for the year.
   Note: a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data.
3. Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4. Develop a program to find the factorial of given number using recursive function calls.
5. Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6. The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:
   a) Find the Pearson and Spearman correlation coefficients. Are they similar?
   b) Plot the data using the plot command.

c) Plot the logarithm (log) of each variable and see if that makes a difference.

7. Develop R program to create a Data Frame with following details and do the following operations.

Item code	Item category	Item price
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies"
c) Create another Data Frame called "item-details" with three different fields item code, ItemQtyonHand and ItemReorderLvl and merge the two frames

8. Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.
a) Assigning names, using the air quality data set.
b) Change colours of the Histogram
c) Remove Axis and Add labels to Histogram
d) Change Axis limits of a Histogram
e) Add Density curve to the histogram

9. Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start date, dept. Import into R and do the following analysis.
a) Find the total number rows & columns
b) Find the maximum salary
c) Retrieve the details of the employee with maximum salary
d) Retrieve all the employees working in the IT Department.
e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"

10. Using the built-in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors
Develop R program, to solve the following:
a) What is the total number of observations and variables in the dataset?
b) Find the car with the largest hp and the least hp using suitable functions
c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?

d) What is the average difference of gross horsepower (hp) between automobiles with 3 and 4 number of cylinders (cyl)? Also determine the difference in their standard deviations.

e) Which pair of variables has the highest Pearson correlation?

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	-	2	3	-	2	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Conduction of Lab	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**DATA ANALYTICS WITH EXCEL**		
Course Code	**24CB308B**	**L-T-P-C**	**(0-0-2) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: To perform Data analytics using Excel.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the mathematical calculations in Excel	1, 2	2
2.	Apply sorting, filtering and condition formats for the given problem	2,3,4	1
3	Visualize results of excel charts for the given problem.	1,5,11	1,2

List of Experiments:

1. In a company, 30 employee details (name, Date of Joining, Qualification, and Salary) are stored in Microsoft Access Database and text file. Using Excel tool imports the data from different sources for analysis and perform the following:
   a. Show average salary.
   b. Show salary between 30000/- and 50000/-
   c. Sort the employee list on the date of joining.
2. Suppose a class of size 40 having SGPA of 8 semesters between 5 to 10. Calculate the CGPA of each student in below Grade form:

O	S	A	B	C
100>=9	8 - 8.9	7 – 7.9	6 – 6.9	5 – 5.9

3. Create 40 students name in the form of First name, Middle name and Last name. Concatenate all the names and store in one column and find the length of each name.
4. Suppose your customer survey results from the east and west regions, month wise are

Month	East	West	Low (<50%)	Medium (50%-80%)	High (>80%)
Apr-15	86.4%	63.0%	50%	30%	20%
May-15	45.8%	58.9%	50%	30%	20%
Jun-15	44.1%	81.6%	50%	30%	20%
Jul-15	77.6%	86.1%	50%	30%	20%
Aug-15	80.7%	95.0%	50%	30%	20%

   For the above date, display customer satisfaction survey using Band Chart.
5. A Person takes a loan of Rs. 5,00,000/- for a tenure of 30 years, find the monthly payments (EMI) for the varied interest rates (Assume interest rate start with 12% and incremented by 2% in each month). Calculate the amount of interest and Principal that is paid in the second year. (use what if Analysis tool)
6. Suppose there is a bookstore that has 100 books in storage. The original price of the book is 250

and decided to offer a discount. Later, the book store announced a 10% discount on that book and cleared off the stock. You might want to know how many books are sold at the original price to obtain total revenue of 24,500.

7. Suppose you want to have a report displaying the following
    a. Data for five disciplines - Archery, Diving, Fencing, Figure Skating and Speed Skating.
    b. Regions that scored more than 80 medals in these 5 disciplines.
    c. The count of medals in each of the five disciplines in each of these regions.
    d. Total count of medals for the five disciplines in each of these regions.
8. Consider the data of 30 employees are stored in two different tables. First table consists of name, employee ID and Second table consists of employee ID, salary. Find the employee salary using lookup table from second table to first.
9. In Olympic, 20 countries participated and won various medals by male and female in equal propositions. Display the medal count for each country with the charts (Pie, Column, Bar, Line, Scatter, and Bubble).
10. Consider the sequence of data from 1 to 100, where Male are 48% and Female are 52% in the data. For the given data create Male vs Female Info-graphic Chart, Male vs Female Ratio Chart and Waffle chart.

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2
CO2		3	2	2	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	2	-	-	-	-	-	2	2	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Conduction of Lab	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
			Total Learning Hours/Semester	**30**

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Course Title	**DATA VISUALIZATION WITH PYTHON**		
Course Code	**24CB308C**	**L-T-P**	**(0-0-2) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: To explore principles and techniques of data visualization using Python.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate the use of IDLE or PyCharm IDE to create Python Applications	1, 5	-
2.	Apply various visualization techniques using suitable python libraries.	2, 5	2
3	Implement, document and present the data visualization projects for the chosen problems.	4, 11	2

List of programming using Python libraries

1. Write a Python program to read data from a CSV file and create a line plot to visualize the trend over time. Customize the plot with appropriate labels, title, and colors.
2. Load a dataset containing information about students' scores in different subjects. Create a scatter plot to visualize the relationship between two variables (e.g., math score vs. science score). Use Seaborn to enhance the plot with appropriate styling and add labels.
3. Given a dataset with multiple variables, create a figure with two subplots: one displaying a line plot and the other showing a bar chart. Customize the subplots with appropriate titles, legends, and colors.
4. Load a dataset containing information about employees' salaries across different departments. Create a box plot and a violin plot to visualize the distribution of salaries by department. Customize the plots and add appropriate labels and titles.
5. Load a dataset containing stock prices over time. Create a line plot to visualize the stock prices and add appropriate labels and titles. Format the x-axis tick labels to display the dates properly.
6. Load a dataset containing temperature readings over time. Create an interactive line plot using Plotly, which displays the temperature when hovering over the data points. Add appropriate labels and customize the plot's appearance.
7. Load a dataset with information about population density by country. Create a choropleth map using GeoPandas to visualize the population density. Customize the map's appearance and add a colors legend.
8. Design and implement an interactive dashboard using Dash to display various visualizations. Include at least two interactive controls (e.g., dropdowns, sliders) to update the visualizations dynamically.

Sample Activity Problem:

- Select a dataset related to a specific topic of interest (e.g., climate change, COVID-19). Design a series of visualizations that tell a compelling data story, highlighting key insights and trends. Present the visualizations with appropriate annotations and captions.
- Choose a dataset related to a real-world problem (e.g., retail sales, customer behavior). Explore the dataset, identify interesting patterns, and design a set of visualizations to present the findings effectively. Present the visualizations along with a brief explanation of the insights gained.

MOOC:

1. https://www.coursera.org/learn/python-for-data-visualization
2. https://www.edx.org/learn/data-visualization/ibm-visualizing-data-with-python

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-	2
CO3	-	-	-	3	-	-	-	-	-	-	2	-	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Conduction of Lab	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**VERSION CONTROLLER WITH GiT**		
Course Code	**24CB308D**	**L-T-P**	**(0-0-2) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**28**

Course Objective: To use GitLab/Git and utilize it for software development.
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Construct the repository using various Git commands.	3, 4, 5	1, 2
2.	Demonstrate and document the work carried out	5, 9, 11	1, 2

List of Experiments:

1. Initializing a Repository: Initialize a new Git repository for a simple project. Add a few files to the repository and commit them.
2. Committing Changes: Make changes to the files in the repository and commit them. Practice creating meaningful commit messages
3. Creating and Switching Branches: Create a new branch in the repository, make changes in the branch, and switch between branches.
4. Merging Branches: Create a branch, make changes in both the main branch and the new branch, and merge the changes back into the main branch.
5. Resolving Merge Conflicts: Create a merge conflict by making conflicting changes in two different branches. Practice resolving the conflict using Git's conflict resolution tools.
6. Working with Remote Repositories: Clone a remote repository to your local machine. Make changes locally and push the changes back to the remote repository.
7. Collaborating with Others: Practice collaborating with others using Git. Clone a shared repository, make changes, push the changes, and pull changes made by others.
8. Reverting and Rolling Back Commits: Experiment with reverting commits and rolling back changes to a previous state in the repository using Git commands.
9. Tagging Releases: Tag a specific commit in the repository as a release version. Practice creating annotated tags and lightweight tags.
10. Ignoring Files: Create a .gitignore file to exclude certain files or directories from being tracked by Git.
11. Viewing Repository History: Use Git commands to view the commit history, explore differences between commits, and track changes made over time.

    Branch Management: Practice creating, deleting, and renaming branches in the repository using Git commands.

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MOOC:

1. https://www.coursera.org/learn/version-control-with-git
2. https://www.classcentral.com/course/microsoft-learn-introduction-to-version-control-with-git-2391

eBook:

https://www.oreilly.com/library/view/version-control-with/9781492091189/

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	3	2	2	-	-	-	-	-	-	2	2
CO2	-	-	-	-	3	-	-	-	2	-	2	2	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Conduction of Lab	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**SOCIAL CONNECT & RESPONSIBILITY**		
Course Code	**24SCR**	**L-T-P-C**	**(0-0-2) 1**
Exam Hrs.	**--**	**Hours / Week**	**2**
SEE	**--**	**Total Hours**	**24**

Course Objective: Provide a formal platform for students to communicate and connect with their surroundings and create a responsible connection with society

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Collaborate effectively as a member and leader while integrating sustainability, ethics, and technological adaptability in societal and professional practices.	6, 7, 8, 9, 11	1
2.	Produce well-structured documentaries, photo blogs, and presentations that effectively convey the essence of the learned experiences and cultural connections	5, 10	-

Course Contents:

Module 1	**08 Hours**

Plantation and adoption of a tree: Plantation of a tree that will be adopted by a group of students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Module 2	**10 Hours**

Heritage walks and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsmen, photoblog and documentary on evolution and practice of various craft forms.

Module 3	**08 Hours**

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

Module 4	**10 Hours**

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Course Conduction

A total of 14-20 hours engagement per semester is required for the course. Students will be divided into teams and each team will be handled by two faculty mentors. Faculty mentors will design the activities for evaluation.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

After completion of the social connect, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor.

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Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	3	2	2	2	-	2	2	-
CO2	-	-	-	-	2	-	-	-	-	3	-	-	-

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Semester IV: Syllabus

Course Title	LINEAR ALGEBRA		
Course Code	24MACB401	L-T-P-C	(2-1-0) 3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	28L+12T

Course Objective: To equip students with the theoretical foundations and analytical skills necessary to model and solve real-world problems in artificial intelligence, machine learning, and engineering through the principles of linear algebra.

Course Outcomes (COs): Having studied this course, students will be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Examine suitable solution procedure to solve the linear models, linearly dependency or independency of vectors, the existence of diagonalization of matrix. Apply matrix factorization to applications such as computer graphics.	1,2,3	-
2.	Compute the eigen values/ eigen vectors to the given linear system, suitable matrices arising in magnification, rotation of images using the knowledge of vector space, matrix of linear transformations.	1,2	-
3.	Analyze the application-oriented problems connected with difference equations, Markov chain, and discrete dynamical systems by using the concept of Eigen values, Eigen vectors.	1,2,3	-
4.	Apply the techniques of singular value decomposition, PCA, to analyze the process of data compression/image processing.	2,3	-

Course Contents:

Module 1	10 Hours

Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of non-homogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method.

Applications of solution of system of equations to balance the chemical equations. Traffic flow problem. To find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.

Self-Study- linear models in business and engineering, Partitioned matrices, Matrix factorization, the Leontief input–output model, and application to computer graphics.

Module 2	10 Hours

Vector Space: Introduction: Vector space, subspace, basis of a vector space, and dimension of a vector space. Linearly dependent and independent vectors. Introduction to linear transformation: rank, nullity of a linear transformations, matrix of a linear transformation. Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the image of some points is given.

Applications: Transformation of 3D coordinate in robotic arm.

Self-Study- Bases for Null space and Column space. Change of basis in R^n.

Module 3	10 Hours

Eigen value & Eigen vectors: Computation of Eigen value, Eigen vectors, applications of diagonalization, Jordan canonical form. Application to discrete dynamical systems- coupled

differential equations governing the electrical circuits (systems), applications to difference equations, applications to web page ranking.

Self-Study- Stretching of an elastic membrane, to determine the growth of a population model. Role ofEigen values, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).

Module 4	10 Hours

Orthogonality & Least Square: Orthogonal sets, orthogonal projections, Gram Schmidt process, QR-factorization, least square problems, multiple regression through matrix approach, singular value decomposition theorem, examples. Principal component analysis-applications of PCA to data compression, image processing.

Self-Study- Application of Eigen value Eigen vectors in Signature testing, Face recognition. Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, Eigen vectors.

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Linear Algebra and its Applications	David C. Lay, Steven R. Lay, J.J. McDonald	5th	Pearson Education Ltd.	2015

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Advanced Engineering Mathematics	E. Kreyszig	10th	Wiley	2015
2	Numerical Methods	R. K. Jain, S. R. K. Iyengar	6th	New Age International Pvt.	2014
3	Linear Algebra and its Applications	Gilbert Strang	4th	Cengage Publications	2014

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	-	3	2	-	-	-	-	-	-	-	-	-	-

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Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	-	-	-
3	Student Study Hours–Self Learning	1	14	14
3	Activity Based Learning(ABL1&ABL2)	-	-	27
4	Evaluation of Learning Process	-	-	07
Total Learning Hours/Semester				**90**

Proposed Assessment Plan(for 50marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1. Details of activity 1 2. Details of activity 2	20
Total		**50**

Activity Based Learning (27Hours)

ABL1(14 Hours) :Activity 1 details		**Hours**
Writing Assignment with Problems on concerned to real world applications.	Submission of the final assignment report and evaluation.(Questions of Blooms level L3 and Higher)	14
Total		**14**
ABL2(13Hours):Activity 2 details		
Problem Solving Assignment	Understand the input data requirements	1
	Formulate the methodology	4
	Design the solution	4
	Solving the problem and submission	4
Total		**13**

Evaluation of Learning Process (7Hours)

Type of Evaluation	**Hours**

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Tests(1,2 and 3)	3
Activity(1and2)	1
Semester End Exam	3
Total	**7**

Course Title	**THEORETICAL FOUNDATIONS OF COMPUTATION**		
Course Code	**24CB402**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Students will learn computation theory fundamentals and design automata, formal languages, and grammars for advanced applications

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understand the fundamental concepts of formal languages and automata theory	1,3	-
2.	Design DFAs, NFAs, and perform conversions among them	3	-
3.	Design regular expressions, context free grammar, Push Down Automata and Turing machines for different levels of formal languages	3	1

Course Contents:

Module 1	**10 Hours**
Introduction to Finite Automata: Why Study Automata Theory? The Central Concepts of Automata Theory. Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, on Deterministic Finite Automata, Finite Automata with Epsilon-Transitions.	
Module 2	**10 Hours**
Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions. **Properties of Regular Languages**: Proving Languages Not to Be Regular – Pumping Lemma, Closure Properties of Regular Languages, Equivalence and Minimization of Automata	
Module 3	**10 Hours**
Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. **Pushdown Automata**: Definition of the Pushdown Automata, The languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata	
Module 4	**10 Hours**
Properties of Context-Free Languages: Normal Forms for Context-Free Grammars-Eliminating Useless symbols, eliminating epsilon productions, Eliminating Unit productions, Chomsky Normal Form (CNF), Griebach Normal Form (GNF). **Introduction to Turing Machines**: Problems that Computers cannot Solve, The Turing Machine Programming Techniques for Turing Machines.	

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Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Automata Theory, Languages and Computation	J.P. Hopcroft, Rajeev Motwani, J.D. Ullman	3rd	Pearson Education	2017

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Languages and Theory of Computation	John Martin	3rd	Tata McGraw-Hill	2007
2	An Introduction to Formal Languages and Automata	Peter Linz	4th	Narosa Publishing House	2011

eBooks and online course materials:

1. Theory of Computation - https://onlinecourses.nptel.ac.in/noc22_cs63

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	-	2	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	3	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	3	14	42
2.	Integrated Lab Component	-	-	-
3.	Student Study Hours – Self Learning	1	14	14
4.	Evaluation of Learning Process	-	-	07
5.	Activity Based Learning (ABL1 & ABL2)	-	-	15+12 = 27
Total Learning Hours/Semester				90

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Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Design and Simulation of Automata Models (15 Hours) 1. Select real-world pattern recognition or lexical analysis problems to model using Finite Automata – 2 hrs 2. Design and simulate Deterministic and Non-deterministic Finite Automata (DFA & NFA) for simple inputs – 5 hrs 3. Apply Epsilon-transitions and convert NFA to DFA – 3 hrs 4. Construct and test Regular Expressions for token validation (e.g., identifier, number, keyword) – 3 hrs 5. Document the automaton, transitions, and use cases with input/output validation – 2 hrs	**15**
ABL 2 – Grammar Construction and PDA/TM Simulation (12 Hours) 1. Construct Context-Free Grammars (CFGs) for arithmetic expressions and nested structures – 3 hrs 2. Design Parse Trees and test ambiguity in CFGs – 2 hrs 3. Implement Pushdown Automata (PDA) for balanced parentheses and palindromes – 3 hrs 4.Convert CFG to CNF and simulate PDA equivalence – 2 hrs 5. Demonstrate a basic Turing Machine operation using visual tools (e.g., TM simulator) – 2 hrs	**12**
Total Learning Hours/Semester	**27 rs**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	3
Presentation and Viva	1
Semester End Exam	3
Total	**7**

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Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS**		
Course Code	**24CB403**	**(L-T-P)C**	**(3-0-2) 4**
Exam	**3Hrs**	**Hours/Week**	**5**
SEE	**50 Marks**	**Total Hours**	**40L +14P**

Course Objective: Students will be able to design algorithms using various strategies and analyze it mathematically.

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

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply various algorithm design techniques to solve the given problem.	2	-
2.	Analyse the time complexity of the algorithm using asymptotic notations.	2	-
3.	Differentiate tractable & intractable problems & apply techniques that help to cope up with limitation of algorithms power.	3	-
4.	Conduct experiments to implement the designed algorithms	3, 5	2

Course Contents:

Module 1	**10 Hours**

Introduction: Notion of Algorithm, Fundamentals of algorithmic problem solving. **Fundamentals of the Analysis of Algorithm Efficiency:** Analysis framework, Asymptotic notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples.

Brute Force: Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive search.

Module 2	**10 Hours**

Divide-and-Conquer: Binary Search, Merge Sort, Quick Sort, Binary tree traversals and related properties, Multiplication of large integers, Strassen's Matrix multiplication.

Decrease-and-Conquer: Insertion Sort, Depth First and Breadth First Search, Topological sorting, Algorithms for generating combinatorial objects.

Module 3	**10 Hours**

Transform-and-Conquer: Pre-sorting, Balanced Search Trees, Heaps and Heap Sort, Problem reduction.

Space and Time Trade-off: Sorting by counting, Input enhancement in string Matching (only Horspool), Hashing.

Dynamic Programming: Computing a Binomial coefficient, Warshall's Algorithm, Floyd's algorithms, The Knapsack problem.

Module 4	**10 Hours**

Greedy Technique: Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm, Huffman trees,

Limitations of Algorithm Power: Lower-bound arguments, Decision trees, P, NP and NP-Complete Problems, coping with the Limitations of Algorithm Power: Backtracking, Branch-and-bound.

Self-Study Components:

Real-World Applications of Greedy and Dynamic Programming, Case Studies on NP-Complete Problems, Algorithm Visualization Tools (e.g., Visualgo), Online Coding Practice on Sorting and Graph Algorithms, Reading on Algorithm Complexity and Big-O Analysis

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Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd Edition	Pearson Education	2017

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Algorithms	Thomas H. Coremen, Charles E. Leiserson, Ronald L Rivest	3rd Edition	PHI	2022
2	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S		Galgotia Publications	

eBooks and online course materials:

1. https://nptel.ac.in/courses/106/106/106106131

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	-	-	-	-	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**14**	**30**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**120**

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Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Algorithm Design, Implementation & Analysis (15 Hours) 1. Select a set of real-world problems (e.g., sorting a list, pathfinding, scheduling) and map them to appropriate algorithmic strategies – 2 hrs 2. Implement brute force and divide-and-conquer approaches (e.g., selection sort, binary search, merge sort) and compare performance – 5 hrs 3. Visualize and analyze recursive vs non-recursive approaches with time complexity evaluation – 3 hrs 4. Implement graph traversal algorithms (DFS, BFS) and topological sorting – 3 hrs 5. Submit documented source code and performance analysis report – 2 hrs	**15**
ABL 2 – Advanced Problem Solving Using Greedy, Dynamic Programming & NP Concepts (12 Hours) 1. Implement and analyze classic dynamic programming solutions (e.g., Knapsack, Floyd's algorithm) – 4 hrs 2. Develop greedy algorithm implementations (e.g., Prim's, Kruskal's, Dijkstra's, Huffman coding) – 4 hrs 3. Explore one NP-Complete problem and apply backtracking or branch-and-bound to a simplified version – 2 hrs 4. Final evaluation with viva or demo presentation – 2 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	3
Valuation of Codes and Presentation	1
Semester End Exam	3
Total	**7**

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Course Title	**DATABASE MANAGEMENT SYSTEM**		
Course Code	**24CB404**	**L-T-P-C**	**(3-0-2) 4**
Exam Hrs.	**3**	**Hours / Week**	**5**
SEE	**50 Marks**	**Total Hours**	**40L+14P**

Course Objective: Students will acquire the concepts of databases, and application of SQL for solving problems.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Apply the concepts of SQL and relational algebra to find solution to the given problem	1	-
2.	Analyze a given scenario and use appropriate database technique	3, 5	1, 2
3.	Design ER diagram or database for a given scenario	2	-
4.	Conduct experiments of databases using modern tools: Oracle, MongoDB, MySQL	3, 5	1, 2

Course Contents:

Module 1	**10 Hours**

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Advantages of using DBMS approach. Data models, schemas and instances; Three- schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; A sample Database Application; Entity Types, Entity Sets, Attributes and Keys. Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions and Design Issues.

Module 2	**10 Hours**

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN-variations of JOIN, OUTER JOIN operations.

Module 3	**10 Hours**

SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval queries in SQL;Insert,Delete and Update statements in SQL; Additional features of SQL, More complex SQL Retrieval Queries; Views; Schema Change Statements in SQL.

Module 4	**10 Hours**

Database Design:

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys-1NF, 2NF, 3NF, Boyce-Codd Normal Form. Multi-valued Dependencies and Fourth Normal Form; Concurrency control techniques: Two- Phase Locking Techniques for Concurrency control; Concurrency Control Based on Timestamp Ordering

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Self -Study Components:
Real-world applications of ER modeling and schema design, Differences between Relational Algebra and SQL, Exploring NoSQL vs Relational DBMS, Hands-on practice with online SQL platforms (e.g., SQLZoo, W3Schools SQL), ACID properties and isolation levels in DBMS

Lab Component

1. Consider the following schema: EMPLOYEE (Ename, Ssn, Bdate, Sex, Address, salary, Mgrssn, Dno) DEPARTMENT (Dname, Dnumber, Mgrssn, Mgr_start_date) PROJECT (Pname, Pnumber, Plocation, Dnum) WORKS_ON (Essn, Pno, Hours) DEPENDENT (Essn, Dependent_name,Sex) Create above tables by specifying primary key, foreign key and other suitable constraints. Insert atleast 5 tuples to each created table.

   • Retrieve the name and address of all employees who work for the "CSBS" department.
   • For each employee, retrieve the employee's name and the name of his or herimmediate supervisor
   • Find the sum of all salaries of all employees
   • For each department, retrieve the department number, the number of employees in the department and their average salary.

2. Consider the following relation schema: SAILORS (Sid: integer, Sname: string, Rating: integer, Age: real) BOATS (Bid: integer, Bname: string, Color: string) RESERVES (sid: integer, bid: integer, Day: date) Create above tables by specifying primary key, foreign key and other suitable constraints. Insert atleast 5 tuples to each created table. Design a database to the satisfy the above requirements and answer following queries

   • Find all sailors with a rating above 7
   • Find the names of sailors who have reserved boat number 103
   • Find the names of sailors who have reserved a red boat
   • Find the names of sailors who have reserved a red or a green boat

3. Consider the following relation schema: STUDENT (Snum: integer, Sname: string, Major: string, Level: string, Age: integer) CLASS (Cname: string, meets at: string, Room: string, Fid: integer) ENROLLED (Snum: integer, Cname: string) FACULTY (Fid: integer, Fname: string, Deptid: integer) The meaning of these relations is straightforward; for example, enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two-character code with 4 different values (example: Junior: JR etc) Write the following queries in SQL. No duplicates should be printed in any of the answers.

   • Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
   • Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
   • Find the names of all students who are enrolled in two classes that meet at the same time.
   • Find the namesof faculty members who teach in every room in which some class is taught.

4. Consider the relation schema for book dealer database: AUTHOR (Author-id:int, Name: string, City: string, Country: string) PUBLISHER (Publisher-id:int, Name: string, City: string, Country: string) CATALOG (Book-id: int, Title: string, Author-id: int, Publisherid: int, Category-id: int, Year: int, Price: int) CATEGORY (Category-id: int, Description: string) ORDER-DETAILS (Order-no: int, Book-id: int, Quantity: int) Create the above tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation.

   • Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
   • Find the author of the book which has maximum sales.
   • Demonstrate how you increase the price of books published by a specific publisher by 10% • List any department that has all its adopted books published by a specific publisher

5. Consider the 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) Write SQL queries to Create the above tables by properly specifying the primary keys and the foreign keys. Enter at leastfive tuples for each relation.

   • List the titles of all movies directed by 'Hitchcock'.
   • Find the movie names where one or more actors acted in two or more movies.
   • List all actors who acted in a movie before 2000 and also in a movie after 2015.
   • Update rating of all movies directed by 'Steven Spielberg'

6. Consider the following database for a banking enterprise BRANCH (branch-name: String, branch-city: String, assets: real) ACCOUNTS (accno: int, branch-name: String, balance: real) DEPOSITOR (customer-name: String, customer-street: String, customer-city: String) LOAN (loan-number: int, branch-name: String, amount: real) BORROWER (customer-name: String, loan-number: int) Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleastfive tuples for each relation.

   - Find all the customers who have at least two accounts at the Main branch.
   - Find all the customers who have an account at all the branches located in a specific city.
   - Demonstrate how you delete all account tuples at every branch located in a specific city.

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of	Elmasri and Navathe	7th	Addison-	2017

	Database Systems			Wesley	
2	Database Management Systems	Raghu Ramakrishnan, Johannes Gehrke	3rd	McGraw-Hill	2017

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Database System Concepts	Silberschatz, Korth, Sudarshan	5th	McGraw-Hill	2016
2	An Introduction to Database Systems	C.J. Date, A. Kannan, S. Swamynathan	8th	Pearson Education	2016

e

Books and online course materials:

1. http://nptel.ac.in/courses/106106093
2. https://www.edx.org/course/database-systems-concepts-design-gtx-cs6400x

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	2	-	-	-	-	-	-	2	2
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	-	-	-	2	2

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**2**	**14**	**28**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**08**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+13 = 28**
Total Learning Hours/Semester				**120**

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Activity Based Learning (28 Hours)

ABL	Hours
ABL 1 – Conceptual and Relational Modeling (15 Hours) 1. Design an ER diagram for a real-world application (e.g., library, hospital, e-commerce system) – 3 hrs 2. Convert the ER diagram into relational schema with keys and constraints – 4 hrs 3. Implement schema using SQL (DDL commands) – 3 hrs 4. Populate sample data and perform basic queries (SELECT, PROJECT, JOIN) – 3 hrs 5. Submit ER diagram, schema, and query output report – 2 hrs 6. Submit documented source code and performance analysis report – 2 hrs	**15**
ABL 2 – SQL Querying and Database Normalization (13 Hours) 1. Write SQL queries for advanced retrievals including aggregation functions, nested subqueries, and views – 4 hrs 2. Normalize an unnormalized relation through 1NF, 2NF, 3NF, and BCNF – 3 hrs 3. Apply multi-valued dependency concepts and convert a relation to 4NF – 3 hrs 4. Simulate transaction operations and demonstrate concurrency control using SQL scripts (2PL or timestamp ordering) – 3 hrs	**12**
Total Learning Hours/Semester	**27**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3) Details of activity 1 4) Details of activity 2	20
	Total	**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
CIE (1, 2 and 3)	3
Lab Evaluation	2
Semester End Exam	3
Total	**8**

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Course Title	**WEB Programming**		
Course Code	**24CB405**	**L-T-P**	**(3-0-0) 3**
Exam	**3 Hrs.**	**Hours/Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Create web pages with client side and server-side scripting
Course Outcomes (COs): Upon completion of the course, students shall be able to

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the knowledge of HTML/XHTML and CSS in designing webpage.	3	
2.	Develop client-side script to design webpage	3,5	
3.	Design server-side script to create webpage	2,3	
4.	Create web pages using JavaScript, xml, PHP and MySQL for the real world applications.	2,4	

Module 1	**10 Hrs**
Fundamentals of Web, XHTML: Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; the Web Programmers Toolbox. XHTML: Basic syntax; Standard structure; basic text markup; Images; Hypertext Links; Lists; Tables; Forms; the audio element, the video element, organization elements, time element	
Module 2	**10 Hrs**
CSS: Introduction; Levels of style sheets; Selector forms; Property value forms; Font properties. List properties; Color; Alignment of text; The box model; Background images; Theand tags. **JavaScript:** Overview of JavaScript; Syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation, and modification; Arrays; Functions; Pattern matching using regular expressions.	
Module 3	**10Hrs**
JavaScript and HTML Documents: The JavaScript execution environment; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The navigator object. **Dynamic Documents with JavaScript:** Introduction to dynamic documents; Element positioning; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor	
Module 4	**10 Hrs**
XML: Introduction; Syntax; Document structure; Namespaces, XML schemas, Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets. **PHP**: Origins and uses of PHP; Overview of PHP; General syntactic characteristics; Primitives, operations and expressions; Output; Control statements; Arrays; Functions; Pattern matching; Form handling; Files; Cookies; Session tracking; Database Access using PHP and MySQL	

Text Book:
Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson Education

Reference Books:

1. Deitel H.M. and Deitel P.J., "Internet and World Wide Web How to program", Pearson International, 2012, 4th Edition.
2. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson, 2015.

3. ISRD Group: Internet Technology and Web Design, Tata McGraw Hill Publishing Ltd, 2011

MOOCs:
1. https://www.mooc-list.com/course/programming-and-web-beginners-coursera
2. http://nptel.ac.in/courses/117105080/3
3. https://www.coursera.org/specializations/web-design
4. http://www.w3c.org

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	-	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	3	2	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	2	-	-	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Business Process Mapping and ERP Lifecycle Simulation (15 Hours) 1. Select a business domain (e.g., retail, manufacturing, healthcare) and identify key business processes – 3 hrs 2. Create an As-Is vs To-Be process map using flowcharts or swimlane diagrams – 3 hrs 3. Simulate a mini ERP lifecycle with stages: requirement gathering, process mapping, CRP setup – 4 hrs 4. Prepare role-based access mockup and ERP architecture (3-tier design) – 3	**15**

hrs 5. Compile all outputs and present lifecycle document with mapped benefits – 2 hrs	
ABL 2 – ERP Customization, Integration & Evaluation Project (12 Hours) 1. Choose an ERP module (e.g., Sales, Inventory, HR) and draft a customization plan for a real-world scenario – 3 hrs 2. Design mock interface between ERP and external application (e.g., payroll, CRM) and explain integration approach – 3 hrs 3. Simulate unit testing, UAT checklist, and capture user feedback (role-play or form-based) – 3 hrs 4. Conduct a comparative evaluation of ERP products (SAP, Oracle, Microsoft) based on predefined criteria – 3 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Report correction and Presentation	1
Semester End Exam	3
Total	**7**

MALNAD COLLEGE OF ENGINEERING, HASSAN
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Engineering Science Course - II

Course Title	**ENTERPRISE RESOURCE PLANNING**		
Course Code	**24CB406A**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: To provide a practical and strategic understanding of ERP systems, covering business process integration, lifecycle phases, customization, and evaluation of leading ERP packages.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Discuss ERP evolution, components, benefits, and lifecycle.	1,2	-
2.	Apply ERP concepts to design solutions for process integration and business transformation.	1,2	-
3.	Analyze ERP implementation phases including CRP, customization, and interface integration.	2,3	1
4.	Evaluate ERP packages and TCO for implementation strategy decisions.	2	-

Course Contents:

Module 1	**10 Hours**

ERP as a Business Enabler and System Architecture

Evolution of ERP: MRP-I, MRP-II, MIS – Overview and scope of ERP – Business process automation and integration – Productivity improvement – Key ERP modules – Three-tier architecture – Role-based access – Document management systems – ERP lifecycle overview.

Module 2	**10 Hours**

Project Initiation, Core Process Analysis, and CRP

Initiating ERP projects – Prerequisites, activities, and critical success factors – Business process analysis – Gap analysis – To-Be vs As-Is mapping – Conference Room Pilot (CRP) methodology – Pilot strategies – Instance management – Deliverables.

Module 3	**10 Hours**

Customization, Interface Integration, and Testing

Customization planning – Gap resolution – Interface and conversion strategies – Data migration – Unit and system integration testing – Regression testing – User Acceptance Testing (UAT) – Role of users and feedback.

Module 4	**10 Hours**

ERP Implementation, Rollout, and Product Evaluation

Go-live strategies – Post-implementation support – ERP rollout methodology – Project management for ERP – TCO and ROI – Comparative evaluation of ERP vendors: SAP, Oracle, Microsoft, PeopleSoft – ERP for SMEs – Emerging trends (open-source ERP, cloud ERP).

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Self-Study components:
ERP Implementation Failures: Case Studies and Lessons, Open-Source vs Proprietary ERP Systems, Cloud ERP and SaaS Models, TCO vs ROI in ERP Projects, Industry-Specific ERP Trends (e.g., ERP for Healthcare, Education, Manufacturing)

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Enterprise Resource Planning	K. Ganesh, S. Mohapatra, S.P. Anbuudayasankar	1st	Springer	2014

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Enterprise Resource Planning	Alexis Leon	3rd	McGraw Hill Education	2014
2	Concepts in Enterprise Resource Planning	Ellen Monk, Bret Wagner	4th	Cengage Learning	2012

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	3	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**

3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	**Hours**
ABL 1 – Business Process Mapping and ERP Lifecycle Simulation (15 Hours) 6. Select a business domain (e.g., retail, manufacturing, healthcare) and identify key business processes – 3 hrs 7. Create an As-Is vs To-Be process map using flowcharts or swimlane diagrams – 3 hrs 8. Simulate a mini ERP lifecycle with stages: requirement gathering, process mapping, CRP setup – 4 hrs 9. Prepare role-based access mockup and ERP architecture (3-tier design) – 3 hrs 10. Compile all outputs and present lifecycle document with mapped benefits – 2 hrs	**15**
ABL 2 – ERP Customization, Integration & Evaluation Project (12 Hours) 5. Choose an ERP module (e.g., Sales, Inventory, HR) and draft a customization plan for a real-world scenario – 3 hrs 6. Design mock interface between ERP and external application (e.g., payroll, CRM) and explain integration approach – 3 hrs 7. Simulate unit testing, UAT checklist, and capture user feedback (role-play or form-based) – 3 hrs 8. Conduct a comparative evaluation of ERP products (SAP, Oracle, Microsoft) based on predefined criteria – 3 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	**Remarks**	**Marks**
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3) Details of activity 1 4) Details of activity 2	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Report correction and Presentation	1

Semester End Exam	3
Total	**7**

MALNAD COLLEGE OF ENGINEERING, HASSAN
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Course Title	**BUSINESS DATA ANALYTICS FOR ENGINEERING**		
Course Code	**24CB406B**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Students will be introduced to key tools and techniques in data analytics to help students extract insights and support business decisions.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Understand core concepts and applications of business data analytics.	1,2	-
2.	Apply statistical and data analytics techniques using tools like Excel, SQL, Python.	1,2	-
3.	Analyze data using visualization, predictive models, and advanced analytics methods.	2,3	1
4.	Evaluate business problems and recommend solutions using insights derived from data.	2	-

Course Contents:

Module 1	**10 Hours**

Introduction to NumPy: Understanding data types in python, basics of NumPy arrays, NumPy array attributes, array indexing, array slicing, reshaping array, array concatenation and splitting, computations on NumPy Arrays.

Introduction to UFuncs, advanced UFancs features, Aggregation: Min, Max and in between, computation on arrays, rules of broadcasting, broadcasting in practice, comparisons, masks and Boolean logics, indexing, sorting arrays, NumPy's structured arrays.

Module 2	**10 Hours**

Data Manipulation with Pandas: Introduction to pandas objects – Series object, DataFrame object, Index object, Data Indexing and selection for series and DataFrame, Operating on Data in Pandas, Handling missing data, Operating on Null values, hierarchical Indexing, combining datasets using Concat and Append, Merge and Join.

Aggregation and Grouping, Pivot tables, Vectorized string operations, working with Time series- Dates and Times in python, indexing by Time, time series data structures, frequencies and offsets, resampling, shifting and windowing, High-performance Pandas – eval() and query()

Module 3	**10 Hours**

Visualization using Python: Importing matplotlib, setting styles, simple line plots, simple scatter plots, visualizing errors, density and contour plots, visualizing a three dimensional function, Histograms, binning and density, customizing plot legends, customizing ticks.

Three-Dimensional Plotting: Three-dimensional points and lines, three dimensional contour plots, surface triangulation, geographic data with basemap, visualization with Seaborn.

Module 4	**10 Hours**

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Statistics : Measures of Central Tendency, Statistics with Python, Measuring Variance, Normal Distribution, Binomial Distribution, Poisson Discrete Distribution, Bernoulli Distribution, P-value, Exploring Correlation in Python, Create a correlation Matrix using Python, Pearson's Chi-Square Test
Self-Study Components: Broadcasting Rules in NumPy: Real-Life Applications, Handling Time Series Data in Pandas, Choosing Between Matplotlib and Seaborn for Visualization, Understanding the P-value in Hypothesis Testing, Applications of Normal and Binomial Distributions in Business & Science

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Business Analytics: Data Analysis & Decision Making	S.C. Albright, W.L. Winston	Latest	Cengage Learning	2019
2	Python for Data Analysis	Wes McKinney	Latest	O'Reilly	2018

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Data Science for Business	F. Provost, T. Fawcett	Latest	O'Reilly	2013
2	Predictive Analytics	Eric Siegel	Latest	Wiley	2016
3	Competing on Analytics: The New Science of Winning	Thomas Davenport, Jeanne Harris	Latest	Harvard Business Press	2017

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	-

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – NumPy and Pandas-Based Data Handling Project (15 Hours) 1. Select a real-world dataset (e.g., weather, sales, COVID, stock prices) and load it using NumPy and Pandas – 3 hrs 2. Perform data cleaning: handling missing data, filtering, and reshaping arrays – 3 hrs 3. Apply aggregation functions, groupby, and pivoting to derive insights – 4 hrs 4. Merge multiple datasets and apply hierarchical indexing for better analysis – 3 hrs 5. Submit code, visual output, and a short summary report – 2 hrs	**15**
ABL 2 – ERP Customization, Integration & Evaluation Project (12 Hours) 1. Choose an ERP module (e.g., Sales, Inventory, HR) and draft a customization plan for a real-world scenario – 3 hrs 2. Design mock interface between ERP and external application (e.g., payroll, CRM) and explain integration approach – 3 hrs 3. Simulate unit testing, UAT checklist, and capture user feedback (role-play or form-based) – 3 hrs 4. Conduct a comparative evaluation of ERP products (SAP, Oracle, Microsoft) based on predefined criteria – 3 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

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Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Report valuation	1
Semester End Exam	3
Total	**7**

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DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

Course Title	**ENTREPRENEURSHIP AND BUSINESS DEVELOPMENT**		
Course Code	**24CB406C**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: Entrepreneurship and businesses are the basis for economic growth all over the world. They play an important role in employment, income and societal changes, particularly in transition economies.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Describe the structure of modern business enterprise, role of industries and government policies in developing business	6	-
2.	Classify the different types of entrepreneurs and identify the characteristics of a successful entrepreneur	6,8	-
3.	Motivate to take-up entrepreneurship	6	2
4.	Apply the stages involved in starting an enterprise, develop and implement a business plan	6	-

Course Contents:

Module 1	**10 Hours**

Modern Business Enterprises: Role of small scale industries, Concept and definitions of SSI, Government policy and Development of the small scale sector in India, Growth & Performance of small scale industries in India. Problems for small-scale industries, Prospects for small scale industries in a free economy.

Entrepreneurship: Importance of Entrepreneurship, concepts of Entrepreneurship, characteristics of a successful Entrepreneur, classification of Entrepreneurs, Myths of entrepreneurship, Entrepreneurial development models, Profiles of successful entrepreneurs.

Module 2	**10 Hours**

Women Entrepreneurs: Women Entrepreneurship defined, Women entrepreneurship environment, challenges in the path of women entrepreneurship, Strategies for the development of women entrepreneurs, Institutions supporting women entrepreneurs in India, women entrepreneurs in India, Any two case studies Institutions

Supporting Small Business Enterprises: Introduction, central level institutions, State level institutions. Other agencies, Industry associations

Module 3	**10 Hours**

Setting up a Small Business Enterprise: Identifying the business opportunity, Business opportunities in various sectors. Formalities for setting up a small business enterprise

Sickness in Small Business Enterprises: Definition of sickness and Present status of sickness of SSIs in India, Criteria for identifying sickness/incipient sickness, causes for sickness/incipient sickness in SSI, Symptoms of sickness, Cures for SSIs sickness, Any two case studies

Module 4	**10 Hours**

Strategic Management in Small Business: Organization life cycle, strategic management, the essence of business ethics, Financial management in small business: Importance of financial management, working capital management.

Family Business: Importance of family business, Various types of family business, History of the family business, Responsibility and rights of family shareholders of a family business, strategies for

improving the capability of a family business, management development plan in family business, family reunion games promote family value, how to save the family business.
Self-Study Components: Case Studies on Government Schemes for SSIs (e.g., MUDRA, SIDBI, PMEGP), Role of Digital Platforms in Empowering Women Entrepreneurs, Common Legal Hurdles Faced by Startups in India, Understanding Working Capital and Cash Flow in Small Businesses, Succession Planning in Family-Owned Enterprises

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Entrepreneurship Development-Small Business Enterprises	Poornima. M. Charatimat	Latest	Pearson Education in South Asia	

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Dynamics of entrepreneurial development and Management	S.S. Khanka, S. Chand& Co	Latest	Vasant Desai, Himalayan Publishing House Entrepreneurship development New Delhi	

MOOC's:

1. https://onlinecourses.nptel.ac.in/noc21_mg70/preview

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	3
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Business Opportunity Mapping & Entrepreneurial Profile Study (15 Hours) 1. Identify and analyze a promising small-scale business idea in a local/regional context – 3 hrs 2. Conduct a mini survey or secondary research on market demand, potential competitors, and feasibility – 3 hrs 3. Prepare a business opportunity mapping across different sectors (agri, tech, services) – 3 hrs 4. Profile two successful Indian entrepreneurs (1 male, 1 female) and present their entrepreneurial journey and models – 4 hrs 5. Submit compiled report with visual representation (charts or mind maps) – 2 hrs	**15**
ABL 2 – Business Setup Simulation & Strategic Case Analysis (12 Hours) 1. Simulate the process of setting up a small enterprise (choose sector, prepare checklist, legal/formal requirements) – 3 hrs 2. Analyze two real-life case studies of small business success/failure and suggest improvements – 3 hrs 3. Prepare a strategic plan for a family business (roles, succession, capital, challenges) – 3 hrs 4. Group presentation of business strategy with ethical considerations and financial planning – 3 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20

Total	**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Presentation and Viva	1
Semester End Exam	3
Total	**7**

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Course Title	**GRAPH THEORY**		
Course Code	**24CB406D**	**L-T-P-C**	**(3-0-0) 3**
Exam Hrs.	**3**	**Hours / Week**	**3**
SEE	**50 Marks**	**Total Hours**	**40**

Course Objective: students to appreciate the definition and basics of graphs along with types and their examples. Understand the notion of planarity and coloring of a graph.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the history and development of graph theory and apply the fundamental results of graph theory	1	-
2.	Apply various techniques in proving theorems in graph theory.	3	-
3.	Implement algorithms to solve problems in graph theory.	4	-
4.	Apply combinatorial Mathematics to the applications in the Computer Science field.	4	-

Course Contents:

Module 1	**10 Hours**

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials.

Module 2	**10 Hours**

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.

Optimization and Matching: Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory

Module 3	**10 Hours**

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalon Numbers.

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials

Module 4	**10 Hours**

Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator.

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions

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Self-Study Components:
Real-Life Applications of Graph Colouring (e.g., Map Coloring, Exam Scheduling), Case Study on Minimum Spanning Tree in Network Design, Exploring the Catalan Numbers in Computer Science, Understanding Rook Polynomials through Chessboard Problems, Generating Functions in Algorithm Complexity Analysis

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	7th	McGraw Hill	2011
2	Graph Theory with Applications	J.A. Bondy, U.S.R. Murty	—	Macmillan	2016
3	Elements of Discrete Mathematics	C.L. Liu, D.P. Mohapatra	3rd	McGraw Hill	2008

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Graph Theory	Douglas B. West	2nd	Pearson Education	2001
2	Discrete Mathematics	Richard Johnsonbaugh	7th	Pearson Education	2008
4	Applied Combinatorics	Alan Tucker	6th	Wiley	2012

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**3**	**14**	**42**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**1**	**14**	**14**
4.	Evaluation of Learning Process	**-**	**-**	**07**
5.	Activity Based Learning (ABL1 & ABL2)	**-**	**-**	**15+12 = 27**
Total Learning Hours/Semester				**90**

Activity Based Learning (27 Hours)

ABL	Hours
ABL 1 – Graph Construction and Optimization Application (15 Hours) 1. Design and represent different types of graphs (e.g., Euler, Hamiltonian, Planar) with real-world examples – 3 hrs 2. Analyze Euler and Hamiltonian paths using hands-on problems and graph drawings – 3 hrs 3. Apply Graph Colouring on scheduling problems and construct chromatic polynomials – 3 hrs 4. Implement Dijkstra's, Kruskal's, and Prim's algorithms on sample networks (manually or via Python) – 4 hrs 5. Prepare a report summarizing the graph models, algorithms used, and conclusions – 2 hrs	**15**
ABL 2 – Counting Principles and Recurrence Projects (12 Hours) 1. Solve practical problems using permutations, combinations, and Catalan numbers (e.g., seating arrangements, parenthesis matchings) – 3 hrs 2. Apply inclusion-exclusion principle to real-life examples (e.g., overlapping group preferences) – 3 hrs 3. Use generating functions to solve recurrence relations from sample problems – 3 hrs 4. Present one application of recurrence relations (e.g., Fibonacci, Tower of Hanoi) using charts or code – 3 hrs	**12**
Total Learning Hours/Semester	**27 hours**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 2) Details of activity 2	20
Total		**50**

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Evaluation of Learning Process (7 Hours)

Type of Evaluation	**Hours**
CIE (1, 2 and 3)	3
Report valuation and presentation	1
Semester End Exam	3
Total	**7**

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Course Title	**COMPUTER & NETWORK CONFIGURATION**		
Course Code	**24CB407A**	**L-T-P**	**(0-0-2)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: The course aims to provide hands-on experience in assembling, configuring, and maintaining computer hardware.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Apply knowledge to assemble, configure, and test computer hardware systems.	2,5,10	-
2.	Analyze and troubleshoot hardware-related issues using appropriate tools.	2,5,10	-

List of Experiments:

1. Identify internal and external components of a PC system
2. Assemble and disassemble a desktop computer
3. Configure BIOS/UEFI settings
4. Install and configure different operating systems (Windows/Linux)
5. Set up drivers for hardware components
6. Perform memory and storage configuration (RAM upgrade, disk partitioning)
7. Configure display settings for single and dual monitors
8. Set up input/output devices (keyboard, mouse, printer, scanner)
9. Troubleshoot hardware issues using diagnostic tools
10. Create and restore system backups
11. Perform hardware compatibility checks for upgrades
12. Configure power supply and UPS system
13. Update firmware and BIOS
14. Build a basic gaming or office PC within a budget

Course Articulation Matrix:

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	2	-	-	3	-	-	-	-	2	-	-	-
CO2	-	2	-	-	3	-	-	-	-	2	-	-	-

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**POWER BI**		
Course Code	**24CB407B**	**L-T-P**	**(0-0-2)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: o provide hands-on experience in preparing, analyzing, and visualizing datasets using Power BI or Tableau for generating business insights through interactive dashboards and reports.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	**Course Outcomes**	**Mapping to POs**	**Mapping to PSOs**
1.	Apply data preparation and transformation techniques using visualization tools.	2,5, 10	2
2.	Create interactive dashboards and visual reports for real-world business datasets.	2,5,10	-

List of Experiments:

1. Load and clean a dataset using built-in data preparation tools
2. Create bar charts, column charts, and line graphs for sales or revenue data
3. Design interactive dashboards with filters and slicers
4. Use calculated fields and DAX expressions (Power BI) or Table Calculations (Tableau)
5. Build KPI indicators and trend lines for business metrics
6. Create heatmaps and geographical maps for region-wise analysis
7. Implement drill-down and drill-through functionality
8. Perform time-series analysis using date hierarchies
9. Combine multiple datasets using joins and relationships
10. Create pie charts, tree maps, and donut charts for category-wise breakdown
11. Apply conditional formatting and data labels for insights
12. Use bookmarks and buttons to build guided dashboards (Power BI only)
13. Publish dashboards to the Power BI service or Tableau Public
14. Build a mini-project: visualize a complete case study (e.g., sales, HR, finance)

Course Articulation Matrix:

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	2	-	-	3	-	-	-	-	2	-	-	2
CO2	-	2	-	-	3	-	-	-	-	2	-	-	-

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Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**TECHNICAL WRITING USING LATEX**		
Course Code	**24CB407C**	**L-T-P**	**(0-0-2) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: Students will gain hands-on skills in Latex for structured technical document preparation.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply Latex commands to create well-structured documents with text, equations, and images.	2,5, 10	2
2.	Create technical reports and presentations using bibliographies, cross-references, and formatting tools in LaTeX.	2,5,10	-

List of Experiments:

1. **Install and set up LaTeX editors**
   (Overleaf, TeXstudio, or MikTeX/TexLive installation and setup)
2. **Create a basic LaTeX document**
   (Use \documentclass, \begin{document}, \section, \textbf, \emph, etc.)
3. **Format text, paragraphs, and lists**
   (Alignment, indentation, bullets, and numbered lists)
4. **Work with titles, sections, and table of contents**
   (Use \title, \author, \maketitle, \tableofcontents, \section and \subsection)
5. **Insert and format mathematical equations**
   (Inline and displayed math using $...$, \[...\], and equation environment)
6. **Create and format tables and figures**
   (Use table, tabular, figure, includegraphics, captions and labels)
7. **Cross-referencing sections, tables, and figures**
   (Use \label, \ref, and \pageref)
8. **Use bibliographic citations and generate references using BibTeX**
   (Create .bib file and cite with \cite, \bibliographystyle, \bibliography)
9. **Use packages for layout and customization**
   (Import geometry, graphicx, amsmath, hyperref, etc.)
10. **Write a lab report or mini-project in LaTeX**
    (Include abstract, figures, equations, references – suitable for thesis formatting)
11. **Create a professional resume/CV using LaTeX**
    (Use a class like moderncv or custom document setup)
12. **Prepare a scientific presentation using LaTeX Beamer**
    (Design and present slides using \frame, \frametitle, bullet lists, and overlays)

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Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	2	-	-	3	-	-	-	-	2	-	-	2
CO2	-	2	-	-	3	-	-	-	-	2	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	**2**	**14**	**28**
2.	Integrated Lab Component	**-**	**-**	**-**
3.	Student Study Hours – Self Learning	**-**	**-**	**-**
4.	Evaluation of Learning Process	**-**	**-**	**2**
Total Learning Hours/Semester				**30**

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Course Title	**BIOLOGY FOR ENGINEERS**		
Course Code	**24BOK408**	**(L-T-P)C**	**(0-1-0) 1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30**

Course Objective: Realization of relation between Natural Engineering and man-made Engineering.
Course outcomes: At the end of course, student will be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To familiarize engineering students with basic biological concepts	6	-
2.	Apply the interdisciplinary vision of biology to engineering	1,6,8	-
3.	Analyze how biological systems can be designed and engineered to substitute natural system	2,6	-
4.	To develop biological models using AI tools	2,6	-

Course Contents:

MODULE – 1	**7 Hrs.**
Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body- cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.	
MODULE – 2	**8 Hrs.**
Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network).	
MODULE -3	**8 Hrs.**
Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling. Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems. Dynamic Updating DNA Computing Algorithms. Beehive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour.	
MODULE -4	**7 Hrs.**
Artificial Intelligence and Biology: Applications of AI in medical imaging, neural engineering, systems biology, microbiome and data mining.	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Bioinspired Engineering	C.H. Jenkins	1st	Momentum Press	2012

2	A Practical Guide to Bio-inspired Design	Hashemi Farzaneh, Udo Lindemann	1st	Springer	2019

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Human Physiology	Stuart Fox, Krista Rompolski	15th	McGraw-Hill eBook	2022
2	Biology for Engineers	Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., Jaganthan M.K.	1st	Tata McGraw-Hill	2012
3	Biology for Engineers	Sohini Singh, Tanu Allen	1st	Vayu Education of India	2014

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	-	3	-	-	-	-	-
CO3	-	2	-	-	-	3	-	-	-	-	-	-	-
CO4	-	2	-	-	-	3	-	-	-	-	-	-	-

Teaching - Learning – Evaluation Scheme:

Sl. No.	Teaching Learning Method	No. of Hours/week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning			
2.	Integrated Lab Component			
3.	Student Study Hours – Self Learning			
4.	Evaluation of Learning Process			
5.	Activity Based Learning (ABL1 & ABL2)			
Total Learning Hours/Semester				

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Course Title	**UNIVERSAL HUMAN VALUES**		
Course Code	**24UHV**	**L-T-P-C**	**(0-1-0) 1**
Exam Hrs.	**3**	**Hours / Week**	**2**
SEE	**50 Marks**	**Total Hours**	**30 Hrs.**

Course Objective: This course cultivates value education through self-exploration, strengthening self-reflection, commitment, and courage for a transformative student experience..
Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Start exploring themselves, get comfortable with each other	6, 7, 8, 9,	-
2.	and with the teacher and they start appreciating the need and relevance to the course. Also, they can note that natural acceptance (intention) is always for living in harmony.	11	
3.	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	6, 7, 8, 9,11	-
4.	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them	6, 7, 8, 9,11	-

Course Contents:

Module 1	**06 Hours**
Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations	
Module 2	**06 Hours**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.	
Module 3	**06 Hours**
Harmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust'– the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order. **Whole existence as Coexistence**: Understanding the harmony in Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self- regulation in nature. Include practice sessions to discuss human beings as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	

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Module 4	**06 Hours**
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct a Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	
Self-Learning Activities- 1. Sharing about Oneself and Exploring Natural Acceptance 2. Exploring Harmony of Self with the Body 3. Exploring the Feeling of Respect 4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence 5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order	

Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	2nd	Excel Books	2010

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Human Values: A Source Book	I.C. Sharma	1st	Aakar Books	2009
2	Value Education and Professional Ethics	R. R. Gaur, R. Sangal, G. P. Bagaria	1st	Excel Books	2010

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	3	2	2	2	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	3	2	2	3	-	3	-	-
CO4	-	-	-	-	-	3	2	2	3	-	3	-	-

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