

SEMESTER 3

Bachelor of Computer Application (Hons)

SEMESTER 3

STATISTICAL AND NUMERICAL METHODS

Course Code	BCPCT301	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	2:1:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	• To develop problem-solving skills using abstract algebraic and arithmetic structures. • Understanding of algebraic concepts, including solving equations & inequalities	Course Type	Theory

Course Objectives:

- The course on Statistical and Numerical Methods covers fundamental topics including descriptive statistics (measures of central tendency and dispersion), concepts in numerical methods and operations research, emphasizing error analysis and solution techniques for algebraic and transcendental equations. Students will develop skills in polynomial interpolation, numerical integration, and explore fundamental principles of operations research, including linear programming.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	STATISTICAL MEASURES: Measures of central tendency - Mean, Median, Mode, Harmonic mean(HM), Geometric mean(GM) Measures of dispersion - Mean deviation about mean and median, Variance, Standard deviation(SD), Coefficient of variation	9

2	CORRELATION AND REGRESSION: Correlation - Karl Pearson's Rank Correlation coefficient(r), Spearman's Rank correlation coefficient. Regression - Regression lines of Y on X and X on Y, Properties of Regression equations. Curve fitting using Normal equations - Fitting of Straight line, Fitting of Parabola.	9
3	NUMERICAL METHODS 1: Solution of algebraic and transcendental equations – Bisection Method, Regula-Falsi method, Newton-Raphson method Solution of linear systems - Gauss-Seidel and Jacobi iteration methods and convergence. (Proof or derivation of the formula not required for any of the methods in this module)	9
4	NUMERICAL METHODS 2: Interpolation - Forward and Backward finite differences, Newton's forward and backward method, Lagrange's method. Numerical integration -Trapezoidal rule , Simpson's 1/3rd rule Solution of ordinary differential equations - Euler method Runge-Kutta method of fourth order. (Proof or derivation of the formula not required for any of the methods in this module)	9

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply fundamental statistics concepts	K3
CO2	Analyze data using descriptive statistics	K2
CO3	Perform regression analysis	K3
CO4	Develop a solid foundation in numerical methods, acquiring the skills to analyze and solve algebraic and transcendental equations, and gaining a practical understanding of the sources and management of errors in numerical computation.	K2
CO5	Cultivate both a comprehensive grasp and practical proficiency in polynomial interpolation techniques, alongside acquiring expertise in numerical methods for the solution of definite integrals	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

[illegible]

CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	FUNDAMENTALS OF MATHEMATICAL STATISTICS	S.C.GUPTA & V.K.KAPOOR	SULTAN CHAND & SONS	12th EDITION, 2020
2	STATISTICAL METHODS	S. P. GUPTA	SULTAN CHAND & SONS	46th REVISED EDITION, 2021
3	INTRODUCTORY METHODS OF NUMERICAL ANALYSIS	S. S. SASTRY	PHI LEARNING Pvt.Ltd	5th EDITION, 2012
4	ADVANCED ENGINEERING MATHEMATICS	ERWIN KREYSZIG	JOHN WILEY & SONS	10th EDITION, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Fundamentals of mathematical statistics</i>	Gupta, S. C., & Kapoor, V. K.	Sultan Chand & Sons.	2020-12Edn
2	<i>Statistical methods</i>	Gupta, S. P	Sultan Chand & Sons	2021-46th rev. ed..
3	Numerical methods	Kandasamy, P., Thilagavathi, K., & Gunavathi. K	S. Chand & Company Ltd.	Revised ed.
4	<i>Sastry, S. S.</i>	<i>Introductory methods of numerical analysis</i>	<i>PHI Learning Pvt. Ltd</i>	2012 5th ed

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER BCA DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPCT301				
Course Name: Statistical and Numerical Methods.				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		<i>Answer all questions. Each question carries 3 marks</i>	CO	Marks
1		Find Geometric mean from the following data. 57.5 , 87.75 , 53.5 , 73.5 , 81.75.	CO 1	(3)
2		Find the mean deviation from mean for the following values. 25 , 63 , 85 , 75 , 62 , 70 , 83 , 28 , 30 , 12	CO 1	(3)
3		Find the mean of variables x and y , given the following Regression of y on x : $2y - x - 50 = 0$ Regression of x on y : $3y - 2x - 10 = 0$.	CO 3	(3)
4		Derive the normal equations for fitting a straight line by the method of least squares.	CO 2	(3)
5		Find the positive solution of the equation $2\sin x = x$ correct to 5 decimal places by Newton - Raphson method.	CO 4	(3)
6		Solve the following using Gauss - Seidel method $10x - 5y - 2z = 3$, $4x - 10y + 3z = -3$, $x + 6y + 10z = -3$.	CO 4	(3)
7		Using Newton's forward difference formula , find the interpolating polynomial for the following data x : 0 1 2 3 y : 0 2 6 18	CO 5	(3)

8		Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using trapezoidal rule.	CO 5	(3)
PART B				
<i>Answer any one full question from each module. Each question carries 9 marks</i>				
Module 1				
9	a)	Find median of the following values 4,45,60,20,83,19,26,11,27.12,52.	CO 1	(3)
	b)	Find standard deviation from the following data . Also find coefficient of variation size: 0-2 2-4 4-6 6-8 8-10 10-12 frequency : 2 4 6 4 2 6	CO 1	(6)
10	a)	A man travels 600 K .M. by train at an average speed of 60 K.M.p.h , 300 K.M.by boat at an average speed of 15 K.M.p.h.,700 K.M.by plane at 350 K.M.p.h. and 25 K.M.by a taxi at 50 K.M.p.h. Find the average speed of the whole journey.	CO 1	(4)
	b)	Calculate mode from the following data size : 10-15 15-20 20-25 25-30 30-35 35-40 40-45 45-50. frequency: 4 8 18 30 20 10 5 2	CO 1	(5)
Module 2				

1 1	a)	You are given the following data <table><tr><td></td><td>x</td><td>y</td></tr><tr><td>Arithmetic mean</td><td>36</td><td>85</td></tr><tr><td>Standard deviation</td><td>11</td><td>8</td></tr></table> Correlation coefficient between x and y =0.66. Find the two regression equations.		x	y	Arithmetic mean	36	85	Standard deviation	11	8	CO 2	(4)
		x	y										
	Arithmetic mean	36	85										
Standard deviation	11	8											
	b)	The ranks of 10 students in two tests are given below. Calculate the coefficient of correlation by the method of rank difference. Test I : 80 45 55 58 55 60 45 68 70 45 85 Test II: 82 56 50 43 56 62 64 65 70 64 90	CO 2	(5)									
1 2	a)	Calculate Karl Pearson’s correlation coefficient between x and y from the following data. $n=10$, $\Sigma x = 35$, $\Sigma x^2 = 203$,$\Sigma y = 28$, $\Sigma y^2 = 140$, $\Sigma xy = 168$.	CO 2	(3)									
	b)	Fit the parabola $y = a + bx +cx^2$ for the following data by the method of least squares. Estimate the value of y when x=10. x : 1 2 3 4 5 6 7 8 9. y : 2 6 7 8 10 11 11 10 9	CO 2	(6)									
Module 3													
1 3	a)	Solve by using Gauss – Seidel method $2x - 7y - 10z= -17$, $5x+y+3z = 14$ and $x+10y+9z=7$.	C04	(4)									

	b)	Find an approximate root of the equation $3x + \sin x - e^x$ using Regula - Falsi method between 0 and 1.	CO 4	(5)
1 4	a)	Find the root of the equation $f(x) = x^3 - 4x - 9 = 0$ using the Bisection method correct to 4 decimal places.	CO 4	(4)
	b)	Using Jacobi iteration method , solve the system of equations $10x + y - z = 11.19$ $x + 10y + z = 28.08$ $-x + y + 10z = 35.61$.	CO 4	(5)
Module 4				
1 5	a)	Solve the differential equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0)=1$ for $x=0.1$ by taking $h=0.02$ using Euler's method.	CO 5	(4)
	b)	Find the interpolating formula from the following data and find $f(2)$. $x : \quad 1 \quad 3 \quad 4$ $y : \quad 1 \quad 27 \quad 64$	CO 5	(5)
1 6	a)	Use Simpson's 1/3 rule to evaluate $\int_0^1 x^3 dx$.	CO 5	(4)
	b)	Using Runge-Kutta method of order four evaluate $y(0.4)$.Given $f(x,y) = x^2 + y^2$ where $y(0)=1$.	CO 5	(5)

SEMESTER – 3

OPERATING SYSTEMS

Course Code	BCPCT302	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	• C Programming basics • Familiarity with the concepts of data structures	Course Type	Theory

Course Objectives:

- **Understand the fundamental concepts** and role of operating systems in computing environments.
- **Understand process management** techniques including scheduling, synchronization, and deadlock handling.
- **Study memory management** strategies such as paging, segmentation, and virtual memory.
- **Study the concepts of concurrency** and inter-process communication.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Overview, Functions of Operating System Process Management: Concept of a Process, Process States, Process Control Block, Inter Process Communication, CPU Scheduling, Scheduling Algorithms - FCFS, SJF, RR and Priority	9 hrs
2	Process Synchronisation: Critical Section Problem, Semaphores, Deadlocks - Necessary Conditions, Resource-Allocation Graph, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery	9 hrs
3	Memory Management: Main Memory - Logical and Physical Address Space, Memory Allocation and Fragmentation, Paging and Segmentation, Virtual Memory - Demand Paging, Page Replacement Algorithms - FIFO, Optimal and LRU	9 hrs

4	File System: File concept - Attributes, Operations, types, structure – Access methods, Protection. Storage Management: Magnetic disks, Solid-state disks, Disk Structure, Disk scheduling algorithms FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.	9 hrs
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Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
C01	Explain the relevance and functions of Operating Systems in computing devices.	K2

C02	Illustrate the concepts of process management and process scheduling mechanisms employed in Operating Systems.	K2
C03	Explain process synchronization and explain any one method for detection, prevention, avoidance and recovery for managing deadlocks in Operating Systems.	K2
C04	Explain the memory management algorithms in Operating Systems.	K2
C05	Explain the file system and algorithms for storage management in Operating Systems.	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01												
C02												
C03												
C04												
C05												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,	Wiley India	9th Edition Year 2015

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Modern Operating Systems	Andrew S Tanenbaum	Prentice Hall	4th Edition, 2015
2	Operating Systems	William Stallings	Pearson Global Edition	6th Edition, 2015
3	Operating Systems	Garry Nutt, Nabendu Chaki, Sarmistha Neogy	Pearson Education	3rd Edition, 2009
4	Operating Systems	D M Dhamdhare	Tata McGraw Hill	2nd Edition, 2011
1	Modern Operating Systems	Andrew S Tanenbaum	Prentice Hall	4th Edition, 2015
2	Operating Systems	William Stallings	Pearson Global Edition	6th Edition, 2015
3	Operating Systems	Garry Nutt, Nabendu Chaki, Sarmistha Neogy	Pearson Education	3rd Edition, 2009
4	Operating Systems	D M Dhamdhare	Tata McGraw Hill	2nd Edition, 2011

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc106106144/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs100/preview
3	https://archive.nptel.ac.in/courses/106/102/106102132/
4	https://archive.nptel.ac.in/courses/106/105/106105214/

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER BCA DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPCT302				
Course Name: OPERATING SYSTEMS				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 3 marks	CO	Marks
1		Define the term operating system. List any four of its primary functions.	CO 1	(3)
2		Differentiate between preemptive and non-preemptive scheduling with examples.	CO 2	(3)
3		What is a critical section? Briefly explain the bounded buffer problem.	CO 3	(3)
4		Explain necessary conditions for deadlock occurrence.	CO 3	(3)
5		Differentiate between logical and physical address space.	CO 4	(3)
6		Explain the concept of demand paging.	CO 4	(3)
7		List and describe any three file access methods.	CO 5	(3)
8		Explain the LOOK disk scheduling algorithm with an example.	CO 5	(3)
PART B				

<i>Answer any one full question from each module. Each question carries 9 marks</i>				
Module 1				
9	a)	Explain the various states of a process with a neat diagram.	CO 2	(3)
	b)	Describe the structure and role of a Process Control Block.	CO 2	(3)
	c)	Illustrate the Round Robin (RR) scheduling algorithm with an example.	CO 2	(3)
10	a)	Explain inter-process communication with an example.	CO 2	(3)
	b)	Compare FCFS, SJF, and Priority scheduling in terms of performance.	CO 2	(3)
	c)	Discuss the need for process scheduling in multiprogramming systems.	CO 2	(3)
Module 2				
11	a)	Define semaphores. Differentiate between binary and counting semaphores.	CO 3	(3)
	b)	Explain the Resource Allocation Graph and its role in deadlock avoidance.	CO 3	(3)
	c)	List and explain the methods for deadlock recovery.	CO 3	(3)
12	a)	Describe the solution to the critical section problem using semaphores.	CO 3	(3)
	b)	Explain the Banker's Algorithm with a suitable example.	CO 3	(3)

	c)	Differentiate between deadlock prevention and deadlock detection.	CO 3	(3)
Module 3				
1 3	a)	What is fragmentation? How does paging help overcome external fragmentation?	CO 4	(3)
	b)	Compare paging and segmentation.	CO 4	(3)
	c)	Explain LRU page replacement algorithm with an example.	CO 4	(3)
1 4	a)	Describe the working of demand paging.	CO 4	(3)
	b)	Explain Optimal Page Replacement Algorithm.	CO 4	(3)
	c)	Explain FIFO page replacement algorithm with a suitable example	CO 4	(3)
Module 4				
1 5	a)	Explain various file attributes and operations.	CO 5	(3)
	b)	Describe protection mechanisms used in file systems.	CO 5	(3)
	c)	Differentiate between magnetic disks and solid-state disks.	CO 5	(3)
1 6	a)	Explain SSTF and C-SCAN disk scheduling algorithms with examples.	CO 5	(3)
	b)	Write short notes on disk structure and formatting.	CO 5	(3)

	c)	Discuss the importance of disk scheduling in OS performance.	CO 5	(3)

SEMESTER – 3

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code	BCPCT303	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	Data Structures	Course Type	Theory

Course Objectives:

- To introduce design of computer algorithms as well as analysis of algorithms.
- To provide a solid background in the design and analysis of the major classes of algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to algorithm -characteristics, criteria. Asymptotic notations and it's properties - Time complexity, space complexity-complexity calculation, recurrence relation -master's theorem.	10 hrs
2	Divide and Conquer : Binary search, merge sort and quick sort algorithms with analysis Graph : Direct and indirect graph,BFS and DFS traversal - Topological sorting, Dijkstra's algorithm, Basics of AVL tree.	11 hrs
3	Greedy algorithms :general characteristics, problem solving using greedy algorithms, Minimum Spaning Tree (Kruskal, Prim's algorithm) Dynamic Programming : comparison with greedy and divide and conquer , problem solving-Floyd-Warshall algorithm.	12 hrs
4	Backtracking : N queen's problem. Branch and bound : Travelling Salesman Problem Introduction to Tractable and intractable problems, Introduction to complexity classes -P, NP, NP Complete, NP HARD with example.	11 hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand fundamental principles and characteristics of algorithms, time and space complexity using asymptotic notations.	K2
CO2	Apply advanced data structures like AVL trees and perform DFS traversal, Topological Sorting and Master's Theorem for divide and conquer algorithms.	K3
CO3	Apply greedy techniques to graph problems and solve MST using Kruskal, Prim algorithms.	K3

CO4	Apply backtracking and branch and bound techniques	K3
CO5	Understand the suitable design strategy to solve a given problem.	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

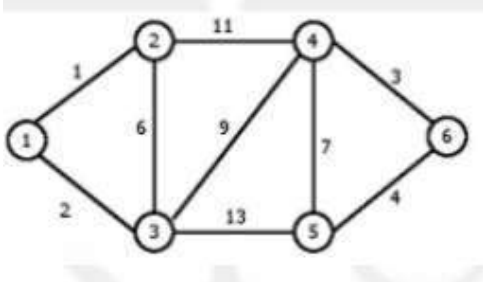
Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

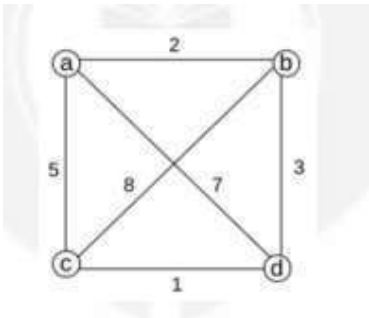
Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	INTRODUCTION TO ALGORITHMS	T.H.Cormen,C.E.Leiserson, R.L.Rivest, C. Stein	Prentice-Hall India	2nd Edition, (2001)
2	Fundamentals of Computer Algorithms”	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran	, Orient Longman Universities Press	2nd Edition, 2008
3	Introduction to design and analysis.	Sara baase and Allen Van Gelder	Pearson education	3rd Edition , 2009

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Statistical methods</i>	Gupta, S. P.	Sultan Chand & Sons.	46th rev. ed. 2021
2	Numerical methods	Kandasamy, P., Thilagavathi, K., & Gunavathi, K.	S. Chand & Company Ltd.	Revised ed. 2020
3	Introductory methods of numerical analysis	Sastry, S. S	PHI Learning Pvt. Ltd.	5th ed. 2012
4	Probability, Statistics and Random Processes	Veerarajan, T.	Tata McGraw-Hill Education.	3rd ed. 2009

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in
2	https://nptel.ac.in/courses/106102064
3	https://youtube.com/@iitkharagpurjuly-is9ie?si=RBDq8j50qrFl-ark
4	https://onlinecourses.nptel.ac.in

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER BCA (HONS) DEGREE EXAMINATION, MONTH AND YEAR				
Course Code:BCPCT303				
Course Name: Design And Analysis of Algorithms				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 3 marks	CO	Marks
1		What are the characteristics of a good algorithm?	CO 1	(3)
2		Solve $T(n)=3T(n/4)+n$ by using the Iteration method.	CO 1	(3)
3		Discuss the terms: best case, worst case and average case in algorithm analysis concerning binary search.	CO 2	(3)
4		Write an algorithm for two-way merge sort.Calculate the time complexity of merge sort.	CO 2	(3)
5		Compare divide and conquer and dynamic programming strategies.	CO 3	(3)
6		How to find spanning trees?Write the applications of spanning trees.	CO 3	(3)
7		Write the control abstraction of the backtracking method.	CO 4	(3)
8		Differentiate between P and NP problems.	CO 4	(3)
PART B				

<i>Answer any one full question from each module. Each question carries 9 marks</i>				
Module 1				
9		Solve the following recurrence equations using Master's theorem. a) $T(n) = 8T(n/2) + 100n^2$ b) $T(n) = 2T(n/2) + 10n$	CO 1	9
10		What is the need of asymptotic analysis in calculating time complexity?? What are the notations used for asymptotic analysis?	CO 1	9
Module 2				
11		Define AVL tree.What is the advantage of AVL tree?Construct an AVL tree with nodes 30,40,10,50,20,5,35.	CO 2	9
12	a)	Write the applications of BFS and DFS.	CO 2	4
	b)	Write Dijkstra's algorithm for single source shortest path.Perform its complexity analysis.	CO 2	5
Module 3				
13		Construct the minimum spanning tree for the given graph using Kruskal's algorithm. Analyse the complexity of the algorithm. 	CO 3	9
14	a)	Write floyd-warshall algorithm and analyse its complexity.	CO 3	5

	b)	Write Bellman-ford algorithm and analyse its complexity.	CO 3	4
Module 4				
15		Show the space tree for the 4-Queens problem. Show the steps in solving the 4 Queens problem using the backtracking method to print all the solutions.	CO 4	9
16		Define Travelling Salesman Problem (TSP). Apply branch and bound algorithm to solve TSP for the following graph, assuming the start city as 'a'. Draw the state space tree. 	CO 4	9

SEMESTER 3

Database Management Systems

Course Code	BCPCT304	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3-1-0-0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT204	Course Type	Theory

Course Objectives:

- To provide a comprehensive understanding of database management systems, including data models, ER modelling, relational model concepts, SQL, and transaction management, enabling students to design, implement, and manipulate relational databases.
- To develop proficiency in advanced topics such as normalization and NoSQL databases, preparing students to handle modern data storage and retrieval challenges efficiently.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to DBMS: Types of Data- structured, semi-structured and unstructured data-Database Management Systems (DBMS)-Purpose of DBMS, Database applications, Characteristics of Database approach. Database Users, Data Models. Three-schema architecture, Database Languages (DDL, DML, DCL)	9 hrs
2	Entity Relationship Modelling and Relational Model: Entity-Relationship Model- Keys: Primary key, Candidate key, Foreign key and super key. Basic concepts of ER model, entity set, attribute and Relationships. ER Diagrams- Strong/Weak entities, Structural Constraints. Relational Model: Relational Database Design Using ER-to-Relational Mapping. Integrity constraints. Relational model concepts, Relational Algebra:- Select, Project, Union, Set difference, Cartesian product, Rename, Join operations-.Equi-join, natural join. Query examples.	13 hrs

3	SQL Queries and Transactions: Introduction to Structured Query Language (SQL), Data Definition Language (DDL), Table definitions and operations – CREATE, DROP, ALTER, INSERT, DELETE, UPDATE, Basic structure of SQL DML, Basic concepts of Aggregate functions, View and Assertions. Transaction Management - Transaction Processing : Introduction to problems and failures in transaction, Desirable properties of transaction(ACID).	11hrs
4	Database Normalization: The idea of normalization-Functional dependency- Definition, Closures, Equivalence of functional dependencies. Normal Forms-First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce Codd Normal Form (BCNF). Decomposition:-Lossless join and dependency preserving decomposition. NoSQL Databases: Introduction to NoSQL Databases, characteristics and categories. Basics of Key- value, document, column-family and graph databases.	11 hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
C01	Understand the fundamental concepts of Database Management Systems including types of data, architecture, data models, and database languages.	K2
C02	Apply entity-relationship modelling and relational design principles to represent real-world scenarios and translate ER diagrams into relational schemas.	K3
C03	<i>Apply SQL queries for data definition and manipulation, including use of aggregate functions, views, and assertions; explain the concept of transaction management</i>	K3
C04	Understand normalization techniques up to BCNF to design efficient relational schemas, and compare relational databases with NoSQL systems.	K2
C05		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01												
C02												
C03												
C04												
C05												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Database Systems: Models, Languages, Design and Application Programming,	Elmasri R. and S. Navathe	Pearson Education	2013
2	Database Systems Concepts	Slberschatz A., H. F. Korth and S. Sudarshan	McGraw Hill	6/e, 2011
3	<i>An Introduction to Database Systems</i>	C.J. Date	Addison-Wesley.	8th ed.,2003
4	NoSQL for Dummies	Adam Fowler	John Wiley & Sons	2015

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Database Management Systems</i>	Raghu Ramakrishnan	McGraw-Hill	3 RD EDITION,2003
2	<i>Learning SQL</i>	Alan Beaulieu	O'Reilly Media	3 RD EDITION,2020
3	NoSQL data models: trends and challenges.	Pivert, O.	trends and challenges.	2018

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106105175
2	https://nptel.ac.in/courses/106105175
3	https://nptel.ac.in/courses/106105175
4	https://nptel.ac.in/courses/106105175 , https://nptel.ac.in/courses/106105174

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER BCA DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPCT304				
Course Name: Database Management Systems				
Max. Marks: 60			Duration: 2 hours 30 minutes	
PART A				
		Answer all questions. Each question carries 3 marks	CO	Marks
1		Give examples of three different types of database users and highlighting any one important characteristic of each category.	CO1	(3)
2		What are the major difference between structured, unstructured and semi structured data.	CO1	(3)
3		Distinguish between Super key, Candidate key, and Primary key using a real convincing example.	CO2	(3)
4		Differentiate between theta join and natural join operations.	CO2	(3)
5		Differentiate between DROP and DELETE	CO3	(3)
6		List the ACID properties of transactions.	CO3	(3)
7		Define the term functional dependency. Why some functional dependencies are called trivial?	CO4	(3)
8		What is a key-value database? List its major properties.	CO4	(3)
PART B				
Answer any one full question from each module. Each question carries 9 marks				
Module 1				
9	a)	Explain the difference between database schema and database state	CO1	(3)
	b)	Explain the main four characteristics of the Database Approach that distinguish it from the traditional file-processing approach	CO1	(6)
10	a)	Explain three schema architecture with figure	CO1	(3)
	b)	What is the difference between logical data independence and physical data independence? Which one is harder to achieve? Why?	CO1	(6)
Module 2				

1 1	a)	A company has the following scenario: There are a set of salespersons. Some of them manage other salespersons. However, a salesperson cannot have more than one manager. A salesperson can be an agent for many customers. A customer is managed by exactly one salesperson. A customer can place any number of orders. An order can be placed by exactly one customer. Each order lists one or more items. An item may be listed in many orders. An item is assembled from different parts and parts can be common for many items. One or more employees assemble an item from parts. A supplier can supply (i) Identify and list entities, suitable attributes, primary keys, and relationships to represent the scenario. (ii) (ii) Draw an ER diagram to model the scenario using min-max notation.	CO2	(7)
	b)	What is entity integrity?	CO2	(2)
1 2	a)	Explain relational algebra operations: select, project, union, set difference, and join.	CO2	(5)
	b)	Student(SID, SName, Dept, Year), ource(CID, CName, Credits, Dept), Enrolled(SID, CID, Grade, Semester), Instructor(IID, IName, Dept, Designation), Teaches(IID, CID, Semester, Year) Write relational algebra expressions to find: i) Students who enrolled in "DBMS" ii) Courses that have no enrollment iii) Instructors teaching more than one course	CO2	(4)
Module 3				

1 3	a)	Consider the UNIVERSITY database with the following relations: STUDENT (rollNo, name, degree, year, sex, deptNo, advisor) DEPARTMENT (deptId, name, hod, phone) PROFESSOR (empId, name, sex, startYear, deptNo, phone) COURSE (courseId, cname, credits, deptNo) ENROLLMENT (rollNo, courseId, sem, year, grade) TEACHING (empId, courseId, sem, year, classRoom) PREREQUISITE(preReqCourse, courseId) Write relational algebra expressions for the following queries: i. For each department, find its name and the name, sex and phone number of the head of the department. ii. Find courses offered by each department. iii. Find those students who have registered for all courses offered in the department of Computer Science. iv. Obtain the department Ids for departments with no lady professor. v. Obtain the rollNo of girl students who have obtained at least one S grade.	CO3	(9)
1 4	a)	Consider the following schema and frame Relational Algebra queries for the following problems: Suppliers (SID: integer, SName: string, Address: string) Parts (PID: integer, PName: string, Color: string) Catalog (SID: integer, PID: integer, Cost: real) The key fields are underlined and the domain of each field is given after the field name. (i) Find the names of suppliers who supply red parts (ii) Find the SIDs of suppliers who supply some red part or are at the address '221 Packer Ave' (iii) Find the SIDs of suppliers who supply some red part and some green part	CO3	(6)
	b)	Discuss problems that may occur in transaction processing.	CO3	(3)
Module 4				
1 5	a)	Suppose that we decompose the schema $R = (A, B, C, D, E)$ into (A, B, C) (A, D, E) . Show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds: $F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$	CO4	(9)
1 6	a)	Discuss various normal forms with examples: 1NF, 2NF, 3NF, and BCNF.	CO4	(6)
	b)	Describe key characteristics and differences between relational and NoSQL databases.	CO4	(3)

SEMESTER 3

UI & UX DESIGN LAB

Course Code	BCPBT305	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	2:0:2:2	ESE Marks	40
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	NIL	Course Type	Theory

Course Objectives:

- To impart the basic concepts of user interface design
- To explore the various tools used in UI & UX

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Importance of User Interface- Definition, Importance of good design, Types of User Interface, Web User Interface- Theories, Principles and guidelines of User Interface Design.	11 hrs
2	Foundation of UI Design-Visual Design Principles, Elements of UI, Tools for UI design, Characteristics of good and poor UI design, Colour theory in UI design, UI for different platforms.	11 hrs
3	UX Design-Definition and scope of UX design, UX design Process, Importance of UX design, Fundamentals of UI & UX design, Difference between UI & UX design.	11 hrs
4	Wireframing-definition, Purpose of Wireframing, Tools for wireframing, Prototyping concepts and techniques, Types of Prototyping, Usability testing with prototyping.	11 hrs

Suggestion on Lab Experiments

Tool Suggestion : Maze with FIGMA

NO.	Lab Experiments
1	Create a Digital Illustration of the Indian National Flag Using Design Tools
2	Create and design web page for portfolio
3	Create and design a login and signup screen for a mobile app
4	Design a Homepage Layout for Your College Website
5	Create a Personalized Calendar for Your Birthday Month
6	Design the admin dashboard UI for a web application
7	Develop a Student Admission Registration Interface
8	Design a home page for online shopping cart app
9	Build a Student Timetable Layout for Academic Sessions
10	Create and design a paper prototype for a food ordering app

Example for setting up Maze

Maze – Setup & Getting Started

Step 1: Sign Up

Go to <https://maze.co/>

Click “Start for free” and sign up using your email or Google account.

Step 2: Connect Figma

Once inside Maze, you can import prototypes directly from Figma.

Go to Projects > New Project, then choose to test a Figma prototype.

Authorize Maze to connect with your Figma account.

Step 3: Create Your First Test

Choose a type of test: usability test, survey, card sort, etc.

Follow the step-by-step interface to configure and share your test.

Step 4: Learn Basics

Beginner's guide: <https://maze.co/guides/usability-testing/>

Help Center: <https://help.maze.co/>

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 2 marks (8x2 =16 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 6 marks. (4x6 = 24 marks)	40

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
C01	Demonstrate an Understanding the importance of User Interface and identify various types of interfaces and principles used in web UI design.	K2
C02	Apply visual design principles and tools to create effective user interfaces across multiple platforms.	K3
C03	Apply the UX design process with respect to user-centered design principles.	K3
C04	Apply wireframes and interactive prototypes using appropriate tools and perform basic usability testing.	K3
C05		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Don't Make Me Think: A common sense Approach to web Usability	Steve Krug	New riders	3rd Edition, 2014
2	UX for Beginners: A Crash Course in 100 Short lessons	Joel Marsh	O'Reilly Media	1st Edition, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Smashing UX Design	Jesmond Allen, James Chudley	Wiley/Smashing Media	2012

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/124/107/124107008/

PBL Course Elements

L: Lecture (3 Hrs.)	R: Project (1 Hr.), 2 Faculty Members		
	Tutorial	Practical	Presentation
Lecture delivery	Project identification	Simulation/ Laboratory Work/	Presentation (Progress and Final Presentations)

		Workshops	
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		30

1. Project Planning and Proposal (5 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

2. Contribution in Progress Presentation and Question Answer Sessions (4 Marks)

- Individual contribution to the presentation
- Effectiveness in answering questions and handling feedback

3. Involvement in the Project Work and Team Work (3 Marks)

- Active participation and individual contribution
- Teamwork and collaboration

4. Execution and Implementation (10 Marks)

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Final Result

5. Final Presentation (5 Marks)

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

6. Project Quality, Innovation, and Creativity (3 Marks)

- Overall quality and technical excellence of the project
- Innovation and originality in the project

Creativity in solutions and approaches

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPBT305				
Course Name: UI and UX Design Lab				
Max. Marks: 40			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 2 marks	CO	Marks
1		Define User Interface. Explain its role in computer systems.	CO 1	(2)
2		Compare CLI and GUI with their advantages and disadvantages.	CO 1	(2)
3		Discuss the role of alignment, contrast, and proximity in visual design.	CO 2	(2)
4		Mention any four tools commonly used for UI design and describe their features.	CO 2	(2)
5		Differentiate between UI and UX design?	CO 3	(2)
6		List the consequences of poor UX design?	CO 3	(2)
7		List any two benefits of wireframing in the design process.	CO 4	(2)
8		Name any three popular tools used for wireframing.	CO 4	(2)
PART B				
Answer any one full question from each module. Each question carries 6 marks				
Module 1				

9	a)	Explain the different types of user interfaces with examples:	CO 1	(3)
	b)	Define a Web User Interface with example.	CO 1	(3)
10	a)	Explain any four major principles of user interface design.	CO 1	(3)
	b)	Discuss the significance of User Interface in software applications.	CO 1	(3)
Module 2				
11	a)	List and explain the key elements of a user interface.	CO 2	(3)
	b)	Mention the core visual design principles are commonly applied in UI design Explain with examples.	CO 2	(3)
12	a)	Compare and contrast good UI design and bad UI design using a real-world example or case study.	CO 2	(3)
	b)	Explain color theory in UI design? Why is it important in UI design?	CO 2	(3)
Module 3				
13	a)	Explain the key principles of good UX design?	CO 3	(3)
	b)	Briefly describe the role of UX design in enhancing user satisfaction?	CO 3	(3)
14	a)	Explain the term prototyping in UX design?	CO 3	(3)
	b)	List and explain the major stages in the UX design process.	CO 3	(3)

Module 4				
1 5	a)	Explain the importance and role of wireframing in UX design with examples	CO 4	(3)
	b)	Define prototyping in the context of UX design.	CO 4	(3)
1 6	a)	Describe the relationship between wireframing and prototyping	CO 4	(3)
	b)	Discuss the step-by-step process of building a prototype for a mobile app.	CO 4	(3)

SEMESTER 3

ENGINEERING ENTREPRENEURSHIP AND IPR

Course Code	BCAET306	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	40
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

- To gain knowledge on converting an identified problem to a business idea
- To gain skills on developing a business plan and prototype.
- To gain knowledge on the types of Intellectual property Rights and real-world Intellectual Property issues
- To gain knowledge on the concept and significance of copyright, industrial design and trade secret

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Ideation & Entrepreneurship: What is Ideation? – Innovation- The Entrepreneurial Mindset- Starting a Business- Resources for Aspiring Entrepreneurs-Importance of building a strong team- Team dynamics Identifying problem statement: Idea Generation Techniques- Developing and Refining Ideas Problem and solution canvas preparation: Orientation and canvas introduction- Customer needs assessment - Market segmentation - Competitive analysis -Market entry strategy- Market validation - Regulatory and legal considerations Case Study I: SWOT Analysis	8hrs
2	Business plan preparation : Business plan framework - Market analysis- Product/ service description- Marketing and sales strategy- Operations plan- Financial projections- Risk management Prototype development plan preparation : Prototype requirements	10hrs

	analysis -Technical specifications -Development approach- Development timeline- Resource allocation - Testing and quality assurance -Iterative development and feedback loop -Documentation and version control Case Study II: Prototyping	
3	Fundamentals of IPR: Introduction to Intellectual property(Assets, Property, Intellectual Property) - Need for protection of intellectual property - Intellectual Property Rights – Types(Patent, Trademark, Copyright, Industrial Design, GI, Trade secret) - WIPO (Introduction, Objectives) - TRIPS Agreement (Introduction, Main Features) Patents: - Introduction- Patentable and Non-patentable Invention - Types of patents - Types of patent applications in India - Guidelines for registration of patent(Patent filing step-by-step procedure, flowchart) Trademark:- Introduction - Guidelines for registration - Requirements for filing trademarks - Trademark Infringement - Protection of trademarks Case Study III: Trademark infringement case	9hrs
4	Copyright :Introduction – Rights conferred by copyright – Registration Process– Terms of Copyright – Transfer of copyrights- Copyright Infringement – Software Copyrights Industrial Designs: Introduction – Need for protection of design – Requirements forregistration of designs – Duration of Registration – Application procedure - Cancellation of Registration Trade Secret: Definition – Discovering and Protection of trade secret. Case Study IV : Film Industry	9hrs

Course Assessment Method
(CIE: 0 marks,ESE: 0 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	30	12.5	12.5	60

Case Study:

The course will be evaluated based on a comprehensive Case Study Report submitted at the end of the course. The report should integrate the case studies from each module,

demonstrating a deep understanding of the concepts.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 6 Questions, each carrying 2 marks (6x2 =12marks)	- Each question carries 7 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x7 = 28 marks)	40

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand essential skills needed to become a successful entrepreneur	K2
CO2	Develop a business idea from an identified problem	K3
CO3	Understand Fundamentals of IPR and need for the protection of intellectual property.	K2
CO4	Understand the fundamentals of IPR and analysereal world IP issues	K2
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Managing technology and innovation for competitive advantage	V. K. Narayanan	Pearson education	1 st edn/2006
2	The Engineering Entrepreneur: A Practical Guide to Starting and Running a Successful Engineering Business in India	Saibal Gupta and Ashok Jhunhunwala	Sage Publications	2011
3	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press	2016
4	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education	2001
5	The Law of Copyright and Designs	B.L. Wadehra	Universal Law	5 th edn/2010
6	Indian Patent Law	P. Narayanan	Eastern Book Company	2 nd edn/2020

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Intellectual property: A Power Tool for Economic Growth	Idris K	WIPO Publication No.888 Switzerland	2003
2	The Management of Intellectual Property	Derek Bosworth & Elizabeth Webster	Edward Elgar Publishing Ltd.	2006
3	Intellectual Property Rights: Text and Cases	Dr. R. Radhakrishnan & Dr. S. Balasubramanian	Excel Books	2017
4	Innovision	Chelat Bhuvanachandran	Khanna Book Publishing	2022

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc20_mg35/preview
2	https://onlinecourses.swayam2.ac.in/ntr24_ed51/preview

3	https://onlinecourses.nptel.ac.in/noc21_hs08/preview
4	https://onlinecourses.swayam2.ac.in/cec20_mg30/preview

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
THIRD SEMESTER BCA (Hons) DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCAET306				
Course Name: Engineering Entrepreneurship & IPR				
Max. Marks: 40			Duration: 2 hours 30 minutes	
PART A				
		Answer all questions. Each question carries 2 marks		Marks
1		Comment on the Importance of building a strong team to start a business.	CO1	(2)
2		Explain the market entry strategy of an entrepreneur.	CO1	(2)
3		What are the different marketing and sales strategies of a new business?	CO2	(2)
4		What is Intellectual Property Right (IPR)? List any four types of IPR and explain each with an appropriate example.	CO3	(2)
5		Briefly explain the objectives of the World Intellectual Property Organization (WIPO).	CO3	(2)
6		What are the methods of discovering trade secrets?	CO4	(2)
PART B				
Answer any one full question from each module. Each question carries 7 marks				
Module 1				
9	a	What are the resources available for an Aspiring Entrepreneur in our state?	CO1	(3)
	)			
	b	Comment on various Idea Generation Techniques	CO1	(4)
	)			
10	a	What are Regulatory and legal considerations followed by an entrepreneur?	CO1	(3)
	)			

	b)	Outline the steps involved in preparing a problem canvas.	CO1	(4)
Module 2				
1 1	a)	Explain the steps involved in preparing a business plan	CO2	(3)
	b)	Comment on Financial projections and Risk management involved in a business	CO2	(4)
1 2	a)	A group of students aims to start a drone delivery business. (a) Identify the statutory requirements they need to comply with. (b) Propose how they can validate their idea in the market. (c) Discuss the importance of team roles in executing their plan effectively.	CO2	(7)
Module 3				
1 3	a)	What is a patent? Distinguish between patentable and non-patentable inventions with one example each.	CO3	(3)
	b)	Describe the step-by-step procedure for filing a patent in India.	CO3	(4)
1 4	a)	Define a trademark and explain its importance in protecting brand identity with a suitable example.	CO3	(3)
	b)	Explain the concept of trademark infringement and mention any two examples of how infringement can occur.	CO3	(4)
Module 4				
1 5	a)	Discuss the classification of software according to copyright	CO4	(7)

1 6	a)	Define industrial design. Mention the need for industrial design	CO4	(3)
	b)	Explain the various steps of registration of a design	CO4	(4)

Database Management Systems Lab

Course Code	BCPCL307	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	Knowledge of DBMS	Course Type	Lab

Course Objectives:

1. Implement Entity Relationship diagram for real world Applications
2. Implement and Manage Relational Schema using DDL Commands.
3. Perform Data Manipulations using DML commands and Views.
4. Perform CRUD operations using NoSQL Databases

Experiment
Implement Using Any Relational Database Software
Case Study Design a database for a Library that satisfies the following requirements and is capable of managing books, members, book issues, and returns. Consider the following requirements: Library has many books. Each book has a unique Accession Number, Title, Author, Price, and Book Type (either Lending or Reference). A book also has an Availability Status (Yes or No) indicating whether it can currently be issued. Each book is published by a Publisher. Each publisher is identified by a unique Publisher ID, and also has a Name and an Address. A publisher may publish multiple books. Books are issued to members who are identified by their Membership Number, and has a Name, Address, and a Member Type (Staff or Student). For each issue, the system must record the Member Number, Accession Number of the book issued, Issue Date, and Due Date. Additionally, when a book is returned, the Member, Book Accession Number, Return Date, and Fine (if any) must be recorded. Constraints: 1. Attribute name in the publisher entity should not accept empty values. 2. Attributes title, Book Type and availability in the books entity should not accept empty values. Additionally, set the default value of availability to 'yes'. 3. Attributes Name and Member Type in the member entity should not accept empty values. 4. Attributes Accession Number, Member Number, Issue Date and Due Date in the issues entity should not accept empty values. Attributes Return Date in the returns entity should not accept empty values and set the default value of fine to 0.

Question No.	Questions
1	Draw an Entity-Relationship (ER) Diagram for the above system. Your diagram should clearly indicate entity sets, relationships, attributes with keys (including derived/multivalued if any), and constraints such as cardinality and participation.
2	Convert the ER diagram into a normalized relational schema (3NF or BCNF). Clearly mention all primary keys, foreign keys, and constraints such as UNIQUE, and NOT NULL. Note: The final design will have tables namely, PUBLISHERS, BOOKS, MEMBERS, ISSUES, BOOK_RETURNS
3	Write DDL commands for the following requirements:
	1) Create a database by name Library. 2) Create equivalent tables using already designed normalized relational schema by including appropriate constraints. 3) Add a column named category (VARCHAR (50)) to the <i>books</i> table to indicate the category of the book. 4) Change the data type of the fine column in the <i>book_returns</i> table to DECIMAL (7,2). 5) Rename the column <i>book_type</i> in the <i>books</i> table to type. 6) Rename the table <i>book_returns</i> to returns. 7) Add a constraint to ensure that <i>fine</i> in <i>returns</i> is always non-negative. 8) Add a constraint chk_book_price to ensure that the <i>price</i> in the <i>books</i> table should not be greater than ₹1000. 9) Drop the column category from the <i>books</i> table. 10) Drop the constraint chk_book_price from the <i>books</i> table.
4	Write DML commands for the following requirements:
	1) Insert 5 records to each designed tables. 2) Update the availability of the book with accession number <i>1005</i> to '<i>no</i>', indicating that it has been issued. 3) The address of the member with membership number <i>2002</i> has changed. Update the address to '<i>New Market Road</i>'. 4) Increase the price of all books published by publisher ID <i>101</i> by 10%. 5) Delete all members of type '<i>student</i>' whose names start with '<i>Test</i>'. 6) Delete all books whose price is less than <i>100</i>.
5	Write SQL queries to meet the following demands:

	1) Display all details of the books available in the library. 2) Retrieve books that are currently available for lending. 3) Display the member number and name of all staff members or members living on “Main Road”. 4) List the member number and name of all students whose names start with the letter “A”. 5) Display the accession number, title, and price of books priced between ₹200 and ₹500, sorted by price in ascending order. 6) Display the accession number, title, price, and 10% discounted price for all books. 7) Display the title of each book along with its publisher’s name. 8) List the name of each member, the title of the book they have borrowed, and the issue date. 9) Retrieve the name and total number of books issued to each member. 10) Create a view named <i>available_books</i> that displays all books that are currently available for lending. The view should show accession number, title, author, and price only.
Implement Using Any NoSQL Database software	
Introduction MongoDB is a NoSQL document-oriented database that stores data in flexible, JSON-like documents. In this case study, you will model and manipulate a project repository database using MongoDB collections and documents, applying basic CRUD (CREATE, READ, UPDATE, DELETE) operations. Case Study The Department of Computer Applications wants to maintain a Project database for storing and managing details of student academic projects. Department decides to use MongoDB, a NoSQL database, for this application. Each project has basic details such as: • Project Title (a string field) • Year of Submission (a number field) • Description (a string field) • Project Type (a string field e.g., Mini Project or Main Project) • Student Name (a string field)	
Question No.	Questions
1	Create Operations:
	1) Create a collection named projects. 2) Insert at least three project documents into the <i>projects</i> collection.

2	Read Operations (Query):
	1) Display all project documents in the <i>projects</i> collection. 2) Display the project title, project type and student name for all projects 3) Find all projects that include ' <i>Python</i> ' in their technologies. 4) Find all projects that submitted in the year <i>2004</i> . 5) Display the project title and student name for all projects of type ' <i>Main Project</i> '.
3	Update Operations:
	1) Update the description of a specific project identified by its title.
4	Delete Operations:
	1) Delete a project document by its title.

Course Assessment Method (CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- **Submission of Record:** Students shall be allowed for the end semester examination only upon submitting the duly certified record.
- **Endorsement by External Examiner:** The external examiner shall endorse the record

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply real-world scenarios to design ER diagrams, identify entities, attributes, relationships and constraints and translate them into normalized relational schemas to meet specified requirements.	K3
CO2	Demonstrate the ability to implement relational database schemas using SQL, applying DDL commands to create and modify structures and DML commands to manipulate data while enforcing integrity constraints	K3
CO3	Write advanced SQL queries using joins, sub-queries, aggregate functions and views to manage complex data operations and provide abstraction for efficient data retrieval	K3
CO4	Perform CRUD operations on semi structured data in MongoDB and effectively manage collections and documents.	K3
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw Hill Education	6th Edition, 2011.
2	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B.Navathe	Pearson Education	5th Edition, 2007

3	Next Generation Databases: NoSQL, NewSQL, and Big Data	Guy Harrison	Apress	1st Edition, 14 December 2015
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Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	NoSQL for Dummies	Adam Fowler	John Wiley & Sons	2015
2	SQL Bible	Alex Kriegel and Boris M Trukhnov	John Wiley & Sons	2008

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc25_cs145/preview

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER 4

SEMESTER 4

Linear Algebra and Number Theory

Course Code	BCPCT401	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	2:1:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	Elementary Matrix Operations and Basic algebraic manipulations.	Course Type	Theory

Course Objectives:

- To learn handling of linear systems of equations using matrix as a tool.
- To provide a strong foundation in number theory for cryptographic and algorithmic applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Linear Systems and Matrix Transformations. Linear systems of equations, Solution by Gauss elimination, Row echelon form and rank of a matrix, Fundamental theorem for linear systems - homogeneous and non-homogeneous (without proof), Eigenvalues and Eigenvectors of matrices, Diagonalization of matrices.	9 hrs
2	Vector Spaces and Linear Transformations. Vector Spaces, Examples of vector space $\mathbb{R}^n$ and $M_{m \times n}$ only, Subspaces- Examples as subspaces of $\mathbb{R}^n$ and $M_{m \times n}$. Linear combinations of vectors in a vector space, Spanning sets, Linear dependence and independence, Basis for a vector space, The dimension of vector space. Linear Transformations, Properties of linear transformations, Linear Transformation given by a matrix. Kernel of a Linear Transformation and its basis, Range of a Linear Transformation and its basis, Rank and Nullity of a Linear Transformation, Sum of Rank and Nullity (without proof).	11 hrs

3	Divisibility and Congruences Divisibility: Properties, Division algorithm, GCD and LCM. Well ordering theorem. Euclidean Algorithm and its applications. Relatively prime numbers and Fundamental Theorem of Arithmetic. Congruences: Definition and properties. Linear congruences equation. Chinese Remainder Theorem (statement and applications). (All Theorems without proof)	8 hrs
4	Number-Theoretic Functions . Euler's Theorem(Euler Fermat theorem). Fermat's Little Theorem. Polynomial congruences. Wilson's Theorem. Primitive roots. Arithmetic functions: divisor function $\sigma(n)$ number of divisors $d(n)$. Introduction to multiplicative functions. (All Theorems without proof)	8hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
C01	Solve system of linear equations, to evaluate eigen values and eigen vectors of matrices and to diagonalize matrices.	K3
C02	Explore the concept of vector spaces and subspaces, and utilize the properties of linear transformations.	K3
C03	Describe the principles of divisibility, the division Algorithm, as well as the theory of congruences.	K3
C04	Explore Euler's theorem, Fermat's Little Theorem, Wilson's Theorem and the polynomial congruences.	K3
C05		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01												
C02												
C03												
C04												
C05												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016
2	Elementary Linear Algebra	Ron Larson	Cengage Learning	8 th edition, 2017
3	Elementary Number Theory with Applications.	Thomas Koshy	Academic Press	2 nd edition, 2008
4	Elementary Number Theory	David M Burton	Tata McGraw-Hill	7th Edition, 2006

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Elementary Linear Algebra	Stephen Andrilli & David Hecker	Academic Press	4 th edition, 2010
2	Elementary Linear Algebra	Howard Anton, Chris Rorres	Wiley	11th edition, 2019
3	An Introduction to the theory of numbers.	G H Hardy and E M Wright.	Oxford University Press, London.	4th Edition, 1965
4	Elementary number theory and its application	Kenneth H. Rosen	Addison-Wesley	3rd Edition, 1992

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	1 https://archive.nptel.ac.in/courses/111/107/111107164/
2	https://youtu.be/ZLh4Ud_vjB8
3	https://onlinecourses.nptel.ac.in/noc25_ma102
4	http://digimat.in/nptel/courses/video/111101137/L05.html

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER BCA (Hons) DEGREE EXAMINATION, 2025				
Course Code: BCPCT401				
Course Name: Linear Algebra and Number Theory				
Max. Marks: 60			Duration: 2 hours 30 minutes	
PART A				
		Answer all questions. Each question carries 3 marks	CO	Marks
1		Find the Rank of the Matrix $[1 \ -1 \ 0 \ 1 \ 3 \ -1 \ 5 \ 3 \ -2]$	CO1	(3)
2		Write a linear system of two equations with two unknowns which have infinitely many solutions.	CO1	(3)
3		Show that $\{(x, 2x + 1): x \in R\}$ is not a subspace of R^2 under standard operations.	CO2	(3)
4		Let $T : R^5 \rightarrow R^7$ be a linear transformation. Find the dimension of the kernel of T when the dimension of the range is 3.	CO2	(3)
5		State well ordering theorem with an example	CO3	(3)
6		Use the Euclidean Algorithm to find $\gcd(84, 30)$	CO3	(3)
7		Define the divisor function $\sigma(n)$. Find $\sigma(12)$.	CO4	(3)
8		Verify that 2 is a primitive root modulo 9	CO4	(3)
PART B				
Answer any one full question from each module. Each question carries 9 marks				
Module 1				
9	a)	Find the values of λ and μ for which the system of equations $x - 3y + 4z = 3$. $3x + y - z = 6$. $2x - 6y + \lambda z = \mu$ has (1) no solution (2) a unique solution (3) infinite number of solutions.	CO1	(6)
	b)	Find the eigen vectors of $[1 \ 2 \ 2 \ 4]$	CO1	(3)
10	a)	Diagonalize the Matrix $[4 \ 2 \ -2 \ 2 \ 5 \ 0 \ -2 \ 0 \ 3]$	CO1	(5)
	b)	Solve the homogeneous system $x + y - 2z = 0$.	CO1	(4)

		$2x - y + 3z = 0.$ $-x - y + 2z = 0.$		
Module 2				
11	a)	Show that $\{(1, 2, -3), (0, 1, -2), (1, 1, 0)\}$ form a Basis of R^3 .	CO2	(5)
	b)	The LT, $T: R^2 \rightarrow R^3$ by $T(X) = AX$ where $A = [5 \ -3 \ 1 \ 1 \ 1 \ -1]$. Find $\text{Ker}(T)$	CO2	(4)
12	a)	Check whether the set of vectors $\{(1, 3, 2), (2, -1, 4), (3, 2, 6)\}$ is Linearly independent or not?	CO2	(5)
	b)	Determine whether the function $T: R^2 \rightarrow R^2$ defined by $T(x, y) = (x, 1)$ is a linear transformation.	CO2	(4)
Module 3				
13	a)	Using Euclidean Algorithm, evaluate $(2076, 1776)$.	CO3	(4)
	b)	Solve the linear system $x \equiv 1 \pmod{3}$, $x \equiv 2 \pmod{4}$, and $x \equiv 3 \pmod{5}$ using Chinese Remainder Theorem.	CO3	(5)
14	a)	Find the canonical decomposition of 2520	CO3	(4)
	b)	Solve Sun-Tsu's puzzle by iteration.	CO3	(5)
Module 4				
15	a)	Find the remainder when 24^{1947} is divided by 17	CO4	(4)
	b)	Solve the congruence $24x \equiv 11 \pmod{17}$	CO4	(5)
16	a)	Solve the linear congruence $12x \equiv 6 \pmod{7}$	CO4	(5)
	b)	Show that $2^{341} \equiv 2 \pmod{341}$.	CO4	(4)

SEMESTER 4

Software Engineering

Course Code	BCPCT402	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

- To assist the student in understanding the basic theory of software engineering, and to apply these basic theoretical principles to a software development project
- To acquire a comprehensive understanding of the software development lifecycle and its application in contemporary software engineering practices
- To understand the art of software design, development, and testing to produce robust and efficient software solutions

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Software Engineering and Process Models Introduction: Introduction to Software Engineering: What is Software Engineering? Characteristics of a good software. Layard representation, framework and umbrella activities. Concepts of Process and Product. Life cycle of a software system (SDLC): requirements analysis, design, development, testing, deployment, Maintenance. (Definition and Concepts only) Process Models: Waterfall, Incremental, V model; Prototyping, Spiral model, Predictive and adaptive models. Agile Development: Concepts of Agile Development methodology Core values and principles; Introduction to SCRUM Framework (what is scrum, pictorial representation , roles)	10 Hrs
2	Requirement Engineering and Design Principles Requirements Engineering: Requirements elicitation (Traditional methods, Brainstorming, MoSCoW, FURPS 5W1H methods) Requirement specifications, Software Requirements Specification Documents (need and structure). Software Design: Overview -Design concepts: Modularity, Cohesion and Coupling-, Structured Analysis - Data Flow Diagrams (DFDs). Object Oriented Design-Solid Principles (Single Responsibility, Open/Closed, Liskov Substitution, Interface Segregation, and Dependency Inversion) – Concepts of patterns, major types and uses. Object Modelling Using UML:	13 Hrs

	Basic Concepts - UML Diagrams - Use Case Model - Class Diagrams – Interaction Diagrams - Activity Diagrams. Concepts of Scalability while designing software. Concepts of Agile Design: User Stories, Product Backlog, Sprint, Sprint Backlog with an example.	
3	Coding and Testing Principles Coding Principles: Programming principles and Guidelines; Coding Standards (Basic Concepts, importance, advantages and disadvantages); Common coding errors; Software Documentation (Basic concepts, need and use) Version control systems: Basic concepts, Types (Stand alone, centralized and distributed). Basic concepts of Git repository. Creating a Git repository using GitHub, some basic operations (Clone a repository; View history; Modifying files; Push changes, pull, add, commit) Testing Principles: Software testing principles, Validation and Verification, Basic concepts of - Unit testing, Integration Testing, System Testing, Acceptance Testing, Black box testing: Equivalence class testing, Boundary value testing; White box testing: control flow testing, Data flow testing. Program Inspections, walkthroughs (Basic concepts).	11 Hrs
4	Deployment Principles, Maintenance and Quality management Principles Deployment : Introduction (definition, purpose, checklists, challenges);Deployment Methods- Cutover-Staged, Gradual cutover, Incremental and Parallel testing – Concepts only) Continuous Integration (CI) and Continuous Delivery (CD): Introduction and concepts. Software Build and Automation – introduction and basic concepts Maintenance: Introduction and types (Corrective, adaptive, perfective, preventive), Reengineering, reverse engineering, refactoring Software Quality: Quality Assurance and Quality Control, four dimensions of quality; specification quality, design quality, quality in software development, conformance quality (Concepts only).	10 Hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe a full view of the Software Development Life Cycle and various process models	K2
CO2	Understand and apply various aspects of software requirements and design methods	K3
CO3	Understand coding and testing principles and apply the version control systems in software development process	K3
CO4	Understand the process of deployment and maintenance	K2
CO5	Summarize the activities in software quality, CI/CD & Software Builds.	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Software Engineering,	N.S. Gill	Khanna Publishing House	2023
2	Beginning Software Engineering	Rod Stephens	Wiley India Pvt Ltd	2015
3	Ry's Git Tutorial	Ryan Hodson	Web	2015

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Software Engineering, 9th edition	Ian Somerville	Pearson education.	2017
2	Software Engineering A practitioner's Approach, 8th edition	Roger S Pressman	McGraw Hill Education	2015
3	The Pragmatic Programmer: From Journeyman to Master	Andrew Hunt, David Thomas	Pearson India	2008
4	Agile Software Development: The Cooperative Game, 2nd Edition	Alistair Cockburn	Addison Wesley	2006

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/106/101/106101061/
2	https://onlinecourses.nptel.ac.in/noc20_cs68/preview
3	https://onlinecourses.nptel.ac.in/noc20_cs68/preview
4	https://www.coursera.org/professional-certificates/devops-and-software-engineering

Web Resources	
CI/CD	https://www.redhat.com/en/topics/devops/what-is-ci-cd Retrieved 21 June 2025
The SCRUM Guide	https://www.scrumguides.org/docs/scrumguide/v2017/2017-Scrum-GuideUS.pdf Retrieved 21 June 2025
Build Automation	https://www.browserstack.com/guide/build-automation Retrieved on 21 June 2025
DevOps	https://about.gitlab.com/topics/devops/ Retrieved on 21 June 2025 https://learn.microsoft.com/en-us/devops/what-is-devops Retrieved on 21 June 2025

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER BCA (HONS) DEGREE EXAMINATION, MONTH AND YEAR				
Course Code:BCPCT402				
Course Name: Software Engineering				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 3 marks	CO	Marks
1		List out the characteristics of a good software.	CO 1	(3)
2		Define Core values of Agile Methodology.	CO 1	(3)
3		What are User Stories? How is it useful in requirement engineering process?	CO 2	(3)
4		Discuss the concept of scalability in software design process.	CO 2	(3)
5		Write a note on Coding standards.	CO 3	(3)
6		Differentiate validation and verification.	CO 3	(3)
7		Elaborate the term ‘Refactoring’.	CO 4	(3)
8		Define Risk Management and its role in Software Development	CO 4	(3)
PART B				

<i>Answer any one full question from each module. Each question carries 9 marks</i>				
Module 1				
9	a.	Recall the Steps involved in Software Development Life Cycle	CO 1	(6)
	b.	Explain the layered architecture of Software Engineering	CO 1	(3)
10	a.	Elaborate on Spiral Model of Software Development.	CO 1	(4)
	b.	Illustrate the SCRUM Framework for Agile Development Model.	CO 1	(5)
Module 2				
11		Elaborate on Cohesion with various types.	CO 2	(9)
12		Explain various solid state principles of Object Oriented Design	CO 2	(9)
Module 3				
13	a.	List out common coding errors happened during the coding process	CO 3	(5)
	b.	Explain Version Control Systems with its types	CO 3	(4)
14	a)	Enumerate the advantages and disadvantages of Coding Standards	CO 3	(4)
	b)	Expand the terms Program Inspection and Program Walkthrough	CO 3	(5)
Module 4				
15	a.	Define Deployment Process and explain various methods for deployment.	CO 4	(5)
	b.	Expand the terms Continuous Integration and Continuous Delivery	CO 4	(4)
16		Elaborate on		

	a.	Reengineering Process	CO 4	(3)
	b.	Reverse Engineering Process		(3)
	c.	Software Configuration Management		(3)

SEMESTER 4

COMPUTER NETWORKS

Course Code	BCPCT403	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)		Course Type	Theory

Course Objectives:

- Understand the fundamentals of data communication, transmission modes, network types, and networking devices.
- Learn the structure and functions of network models, with emphasis on the OSI and TCP/IP models.
- Explore core networking layers including Data Link, Network, Transport, and Application layers, along with their protocols and functionalities.
- Analyze and apply routing techniques, addressing methods, and application layer protocols to design efficient and reliable network systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Networks: Types of Networks, Networking Device and its functions, Network Topologies- Star, mesh, bus, ring and hybrid. Transmission modes-Simplex, Half duplex and Full duplex. Network Models: OSI Model- Layers and functions, TCP/IP Model, Comparison of OSI and TCP/IP model.	11 hrs
2	Data Link Layer – Functions of data link layer, Data link layer design issues, Framing techniques, Error detection-parity ,CRC and error correction-hamming code . Basic concepts of flow control and error control., High-Level Data Link Control protocol(HDLC) MAC sublayer & ethernet –channel allocation methods ,Multiple Access Protocols, Ethernet - Frame structure & Basic wired Ethernet standards	11 hrs

3	Network Layer- Design issues, Routing algorithms – Basic principles, Shortest path, Distance Vector and Link State Routing. Introduction to congestion control techniques Quality of Service (QoS) – requirements, Techniques for achieving good QoS. Internet Protocol: Structure of IPv4 protocol, characteristics of IPv6 , subnetting and CIDR Notation, ARP, OSPF, BGP.	11hrs
4	Transport Layer – Introduction to transport layer, Transport layer protocols- TCP, TCP segment structure and three way handshake, UDP- Features, UDP segment structure and applications Application Layer – Functions, role in supporting user applications, Application layer protocols-Domain Name System, HTTP/HTTPS: Structure and Operation, File Transfer Protocol(FTP), Concepts of email protocols	11hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamental concepts of Computer Networks including data communication, transmission modes, network devices network topologies and Compare OSI and TCP/IP models.	K2
CO2	Explain the functions of the data link layer and MAC Sublayer protocols including Ethernet standards	K2
CO3	Explain the design issues of the network layer, routing and addressing mechanisms, and congestion control and QoS techniques.	K2
CO4	Explain the functions of the transport and application layer	K2
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Communication and Networking	Behrouz. A. Forouzan	McGraw-Hill Education	4th Edition- ,TMH
2	Computer Networks	Andrew S.Tanenbaum	Pearson Education	5 th edition,2011

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Computer Networking: A Top-Down Approach	James F.Kurose, Keith W.Ross	Pearson Education	7 th edition,2017

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/106/105/106105081
2	https://nptel.ac.in/courses/106105183
3	https://archive.nptel.ac.in/courses/106/105/106105183
4	https://onlinecourses.nptel.ac.in/noc25_cs15/preview

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER BCA HONOURS DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPCT 403				
Course Name: COMPUTER NETWORKS				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 3 marks	CO	Marks
1		Difference between OSI Model and TCP/IP Model.	CO 1	(3)
2		What is the function of a router, switch and hub in a network	CO 1	(3)
3		Differentiate between pure aloha and slotted aloha.	CO 2	(3)
4		Draw and label the Ethernet frame structure.	CO 2	(3)
5		List any three design issues of Network layer.	CO 3	(3)
6		What is congestion in a network? Mention two techniques to control congestion.	CO 3	(3)
7		State any three features of UDP.	CO 4	(3)
8		Explain about email protocols .	CO 4	(3)
PART B				

<i>Answer any one full question from each module. Each question carries 9 marks</i>				
Module 1				
9	a)	With a neat diagram, explain OSI Reference model.	CO 1	(6)
	b)	Compare LAN,WAN,MAN	CO 1	(3)
10	a)	Explain the various physical topologies with neat sketches.	CO 1	(5)
	b)	Differentiate between simplex, half duplex and full duplex mode of communication with diagrams.	CO 1	(4)
Module 2				
11	a)	Discuss about the frame formats of HDLC protocol	CO 2	(5)
	b)	A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. Show the actual bit string transmitted.	CO 2	(4)
12	a)	Explain about Multiple Access Protocols in detail	CO 2	(9)
Module 3				
13	a)	Illustrate the subnetting concept. A company is granted the site address 181.56.0.0(class B).The company needs 1000 subnets. Find the number of subnets possible and hosts which can be connected in each subnet.	CO 3	(9)
14	a)	Draw and explain the header format of IPv4 packets.	C03	(5)
	b)	What is the function of ARP?	CO 3	(4)
Module 4				

1 5	a)	What is TCP ? Draw and explain TCP segment header.	CO 4	(5)
	b)	Give the significance of FTP	CO 4	(4)
1 6	a)	Explain about DNS in detail	CO 4	(5)
	b)	Demonstrate the UDP segment structure.	CO 4	(4)

SEMESTER 4

Internet Concepts and Web Programming

Course Code	BCPCT404	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	Computer Networks and programming concepts	Course Type	Theory

Course Objectives:

- To provide a foundational understanding of how the Internet and World Wide Web function, including key protocols, addressing schemes, and architectural models.
- To become familiar with the structure and components of modern web technologies, including web servers, browsers, development tiers, and content delivery mechanisms.
- To develop conceptual knowledge of web design and development practices, including markup, scripting, responsive design, and the use of web APIs and frameworks.
- To get introduced to advanced trends and challenges in web technology, such as cloud hosting, web security, SEO, and the ethical and legal implications of web use.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Internet Fundamentals and Architecture: Evolution of Internet and the World Wide Web Internet Standards: Internet Engineering Task Force(IETF), World Wide Web Consortium (W3C), Internet Corporation for Assigned Names and Numbers. (ICANN) Internet Architecture: Client-Server, Peer-to-Peer Models Communication Protocols: TCP/IP, UDP, ICMP DNS, Domain Registration, IP Addressing (IPv4, IPv6) HTTP, HTTPS – Structure and Methods Web Hosting and Deployment Concepts Email Protocols: SMTP, POP3, IMAP	11 Hrs
2	Web Technologies Overview: Architecture of Web Applications- Web Browsers and Rendering Engines Introduction to Web Servers (Apache, Nginx) Web Development Tiers – Frontend, Backend, Database Web Content Delivery: CDN, Caching, and Load Balancing HTTP Status Codes and Headers	11 Hrs

	SSL/TLS and Certificates – Security Essentials Web Accessibility and Semantic Web Concepts	
3	Markup and Scripting – Conceptual Understanding Structure of HTML and CSS – Roles and Purposes Introduction to Document Object Model (DOM) JavaScript’s Role in Web Interaction (No Coding Focus) Comparison of Scripting Languages: JavaScript, TypeScript, Python Introduction to SPA vs MPA, Responsive Web Design Concepts of Progressive Web Apps (PWA) Overview of Client-side Frameworks (React, Angular, Vue – Conceptual Only) Web API Usage – JSON and RESTful Services	11 Hrs
4	Advanced Internet Concepts and Trends Introduction to Cloud Web Hosting (AWS, Azure – only concepts) Web Services: SOAP vs REST Role of Web in IoT, Smart Systems, and AI Integration Security Concepts: XSS, CSRF, SQL Injection (only theory) SEO Basics and Web Performance Optimization Concepts Introduction to DevOps and CI/CD in Web Deployment Legal, Ethical, and Social Issues in Web Use (Privacy, Copyright, Data Protection)	11 Hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understanding the core Internet technologies and architectures	K2
CO2	Describe the components and workflows of modern web applications	K2
CO3	Explain the principles of web markup, scripting, functionality of modern web interfaces and applications with interactive design	K2
CO4	Understand the emerging trends and challenges in web development	K2
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Internet and World Wide Web – How to Program	Deitel & Deitel	Pearson Education	5 e/d, 2018
2	Web Technology: A Developer's Perspective	N.P. Gopalan	PHI Learning	2 ed, 2014
3	Fundamentals of Web Development	Randy Connolly	Pearson Education	4 ed, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1				
2				
3				
4				
5				
6				
7				
8				

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	
2	
3	
4	

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: PCBCT404				
Course Name: Internet Concepts and Web Programming				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 2 marks	CO	Marks
1		Define Internet Engineering Task Force. State its function.	CO1	(3)
2		List any two E-mail Protocols	CO1	(3)
3		State the purpose of a Content Delivery Network (CDN) in web application performance	CO2	(3)
4		Define the purpose of an SSL/TLS certificate in web security	CO2	(3)
5		Define Progressive Web App (PWA) and mention one key feature.	CO3	(3)
6		Discuss the role of JavaScript in Web Interaction.	CO3	(3)
7		List any two ways artificial intelligence is integrated into modern web applications.	CO4	(3)
8		Discuss the Data Protection issues in Web usage	CO4	(3)
PART B				
Answer any one full question from each module. Each question carries 9 marks				
Module 1				
9	a)	Explain the evolution of the Internet and the World Wide Web from ARPANET to the present.	CO1	(5)
	b)	Differentiate client-server and peer-to-peer models with suitable examples.	CO1	(4)

10	a)	Elucidate the structure of an HTTP request and response. List any three HTTP methods.	CO1	(6)
	b)	Expand SMTP, POP3, and IMAP.	CO1	(3)
Module 2				
11	a)	Describe various tiers of web development with relevant technologies.	CO2	(5)
	b)	Discuss the concept of web accessibility and the importance of adhering to accessibility guidelines.	CO2	(4)
12	a)	Differentiate between static and dynamic web content, and explain where each is preferred..	CO2	(5)
	b)	Explain the importance of TLS certificates and how they are used in HTTPS communication.	CO2	(4)
Module 3				
13	a)	Define DOM. Explain how it allows interaction with web content	CO3	(6)
	b)	Explain the importance of JSON in RESTful web services	CO3	(3)
14	a)	Explain Progressive Web Apps (PWAs) and list three features that make them powerful for users.	CO3	(6)
	b)	Illustrate how client-side frameworks like React, Angular, and Vue improve the development process.	CO3	(3)
Module 4				
15	a)	Differentiate REST and SOAP web services	CO4	(5)
	b)	Enumerate the key concepts of DevOps and explain how CI/CD benefit web deployment.	CO4	(4)
16	a)	List any three common types of web security vulnerabilities and how they affect web applications.	CO4	(6)
	b)	Discuss the legal and ethical issues involved in collecting and storing user data online	CO4	(3)

SEMESTER 4

PRINCIPLES OF DATA SCIENCE

Course Code	BCPCT405	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	BCPCT301	Course Type	Theory

Course Objectives:

- Understand the core concepts of data science, types of data, its evolution, and relation to AI, ML, and DL.
- Apply data mining and preprocessing techniques for knowledge discovery and data quality improvement.
- Build and assess classification models like decision trees, naïve Bayes, neural networks, SVM, and KNN.
- Implement clustering and association mining methods and evaluate models using standard performance metrics

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Data Science: Types of Data-Structured, Semi structured, Unstructured; data sets and patterns, Categorical and non categorical data. Introduction to Data Science- History of Data Science, importance of Data Science. Differences between AI,ML and DL. Real world Applications of data science, Steps in data science process(Textbook1)	8 hrs
2	Data Mining and Preprocessing: Data Mining, Essential steps in knowledge discovery, Mining various kinds of knowledge, Data Mining and Applications. Data, Measurements and data preprocessing: Data Types, Similarity and distance measures; Data quality data cleaning and data integration; data Transformation, Dimensionality Reduction(Textbook 2)	10hrs
3	Classification models: Classification- Basic concepts, Decision Tree. Bayes classification methods- Naïve Bayesian	10 hrs

	Classification. Neural Networks- Multilayer feedforward network, Back propagation. Support Vector Machines, K-Nearest Neighbour Classifiers.	
4	Introduction to Association Mining , Clustering and Evaluation metrics: Associations and correlations. Clustering-cluster analysis, Partitioning methods, Hierarchical clustering methods-Agglomerative and Divisive. Density based method-DBSCAN. Evaluation metrics- confusion matrix, precision and recall ,sensitivity and specificity. F-measure. High Dimensional Space (textbook4-chapter-chapter 2-2.1,2.2 &2.3only)	8hrs

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand and differentiate various types of data and explain the historical evolution and significance of Data Science in modern analytics.	K2
CO2	Describe knowledge of data mining and preprocessing techniques.	K2
CO3	Explain various classification techniques	K2
CO4	Understand association rule mining and clustering techniques	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Fundamentals of data science.</i>	Wagh, S. J., Bhende, M. S., & Thakare, A. D.	Chapman and Hall/CRC..	Ist Edition 2021
2	<i>Data mining: concepts and techniques..</i>	Han, J., Pei, J., & Tong, H	Morgan kaufmann	2023
3	<i>Pattern recognition and machine learning</i>	Bishop, C. M.	<i>Bishop.</i> Springer Science+ Business Media, LLC.	2006
4	<i>Foundations of data science..</i>	Blum, A., Hopcroft, J., & Kannan, R.	Cambridge University Press	2020

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Data mining: Introductory and advanced topics.</i>	Dunham, M. H.	Pearson Education India.	2006
2	<i>Practical data science with R.</i> simon and schuster.	Mount, J., & Zumel, N.	Manning Publication	2019
3	<i>Data Science for Business: What you need to know about data mining and data-analytic thinking.</i>	Provost, F., & Fawcett, T.	" O'Reilly Media, Inc.".	2013
4	<i>Data mining techniques.</i>	Pujari, A. K.	Universities press.	2001

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106106179
2	https://nptel.ac.in/courses/106105174
3	https://nptel.ac.in/courses/106105152
4	https://nptel.ac.in/courses/106106202

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER BCA HONOURS DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: BCPCT405				
Course Name: PRINCIPLES OF DATA SCIENCE				
Max. Marks: 60			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 3 marks	CO	Marks
1		Define structured, semi-structured, and unstructured data with examples?	CO1	(3)
2		List any four real-world applications of data science?	CO1	(3)
3		What are the different types of similarity and distance measures used in data preprocessing?	CO2	(3)
4		Define dimensionality reduction. Why is it important in data science?	CO2	(3)
5		What is the working principle of a Decision Tree classifier?	CO3	(3)
6		Differentiate between Naïve Bayes and K-Nearest Neighbour (KNN) classifiers?	CO3	(3)
7		What is DBSCAN? Mention one advantage over k-means?	CO4	(3)
8		Explain precision, recall, and F-measure with formulas?	CO4	(3)
PART B				
Answer any one full question from each module. Each question carries 9 marks				
Module 1				
9	a)	Define Data Science and explain its historical evolution?	CO1	(3)
	b)	Compare Artificial Intelligence, Machine Learning, and Deep Learning	CO1	(3)
	c)	Explain the steps involved in a typical data science process	CO1	(3)
10	a)	Describe datasets and patterns in data?	CO1	(5)
	b)	Discuss the significance of Data Science in modern analytics?	CO1	(4)
Module 2				

11	a)	Describe following with examples: i) Data cleaning ii) Data integration iii) Data transformation	CO2	(5)
	b)	Explain the concept of knowledge discovery in databases (KDD) and its stages?	CO2	(4)
12	a)	Describe the role of data transformation in data preprocessing. Illustrate with examples	CO2	(5)
	b)	Explain the concept of measurements in data preprocessing? Why is it important to understand data scales?	CO2	(4)
Module 3				
13	a)	Describe the structure of a multilayer feedforward neural network?	CO3	(4)

	b)	Explain the backpropagation algorithm in neural networks?	C03	(5)
14	a)	Explain the working of Naïve Bayes classification with an example?	C03	(5)
	b)	What are Support Vector Machines? Mention their advantages?	C03	(4)
Module 4				
15	a)	What is clustering? Explain agglomerative and divisive hierarchical clustering methods?	C04	(5)
	b)	Define and explain the role of a confusion matrix?	C04	(4)
16	a)	What are association rules? Explain support and confidence?	C04	(4)
	b)	Define high-dimensional data and the challenges it presents?	C04	(5)

SEMESTER 4

WEB PROGRAMMING LAB

Course Code	BCPBT406	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	2:0:2:2	ESE Marks	40
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Internet Concepts and Web Programming	Course Type	Theory

Course Objectives:

- To impart the various techniques for Web Development
- To apply state of the art web technologies in web application development

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Lists, Tables, Images, Hypertext links, Forms, Frames. Basic HTML5 tags: The article tag, figure tag, header tag, hgroup tag, footer tag, navigation tag, section tag, aside tag, address tag, HTML5 Canvas	10 Hrs
2	CSS: Types of Style Sheets, Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags.	11 hrs
3	JavaScripting, Basics and programming fundamentals. Obtaining user inputs with prompt dialogues. Variables, Datatypes, Operators and Functions. Control structure: Conditional and looping statements. JS Objects: Array, String, Date, Math, Number, Boolean. JS Validation: Form validation, Email validation	11 hrs
4	Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTML Server side scripting with PHP, variables, operators, data types and expressions. Flow Control statements- Arrays- Functions -String processing with Regular Expression- Form processing	12 hrs

	Connecting to MySQL with PHP- Performing CREATE, DELETE, INSERT, SELECT and UPDATE operations on MySQL table -Working with MySQL data-Reading from Database	
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Suggestion on Project Topics

NO.	Lab Experiments
1	(a) Create a simple HTML page with a heading ("Welcome to APJ Abdul Kalam Technological University"), a paragraph with some text, and a link to "https://www.ktu.edu.in". (b) Insert an image from your computer or an external URL with the alt text "Sample Image".
2	(a) Create a table with 3 rows and 2 columns. Include headings in the first row, and some data in the subsequent rows. (b) Create an ordered list with the following items: "HTML", "CSS", "JavaScript", "XML" and "PHP". (c) Create an unordered list with the following items: "Python", "Java", "C++", "Delphi" and "BASIC".
3	Create a student registration form with a text input (for name), a radio button (for gender: male/female), and a submit button.
4	Create a simple HTML web page that demonstrates the use of all three types of CSS (Inline, Internal, and External). Include the following: (a) A heading with inline CSS to change the text colour. (b) A section styled with internal CSS (e.g., background colour, font family). (c) A button styled using external CSS (e.g., hover effect, padding, and border radius).
5	Basic JS programs -Even-Odd, Palindrome
6	Number programs-Largest of 3 numbers, Fibonacci series.
7	Array & String programs-Sum of elements of array, Count words of string.
8	Date programs- Display date and time.
9	Validation programs- HTML registration form validation using JavaScript
10	Create XML file to store student information like Enrolment Number, Name , Mobile Number , Email Id
11	Create DTD for the XML File having student information like Enrolment Number, Name , Mobile Number , Email Id
12	Write a php program to print first 10 Fibonacci Numbers
13	Write PHP Script for storing and retrieving user information from MySql table. 1. Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php) 2. Store this data in Mysql database / text file. 3. Next page display all user in html table using PHP (display.php)

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Internal Exam Lab	Total
5	30	7.5	7.5	10	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 2 marks (8x2 =16 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 6 marks. (4x6 = 24 marks)	40

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Demonstrate Internet and HTML tags	K3
CO2	Apply web technologies that enable structuring and presenting hypertext documents on the World Wide Web	K3
CO3	Apply JavaScripting in web development.	K3
CO4	Apply storage and transferring of data in web development	K3
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO1												
CO2												
CO3												
CO4												
CO5												

Reference Books	
https://www.w3schools.com/php/ Retrieved on 26-06-2025	
JavaScript: The definitive guide, David Flanagan, Orielly, 7th, 2020	
https://www.w3schools.com/xml/xml_what.asp Retrieved on 26-06-2025	

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	HTML 5 Black Book,	DT Editorial Services,	Dreamtech Press;	Second edition, 2016
2	Mastering HTML, CSS & Java Script Web Publishing	Jennifer Kyrnin Laura Lemay, Rafe Colburn	BPB Publications	1 e/d, 2016

PBL Course Elements

L: Lecture (3 Hrs.)	R: Project (1 Hr.), 2 Faculty Members		
	Tutorial	Practical	Presentation
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		30

7. Project Planning and Proposal (5 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

8. Contribution in Progress Presentation and Question Answer Sessions (4 Marks)

- Individual contribution to the presentation

- Effectiveness in answering questions and handling feedback

9. Involvement in the Project Work and Team Work (3 Marks)

- Active participation and individual contribution
- Teamwork and collaboration

10. Execution and Implementation (10 Marks)

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Final Result

11. Final Presentation (5 Marks)

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

12. Project Quality, Innovation, and Creativity (3 Marks)

- Overall quality and technical excellence of the project
- Innovation and originality in the project

Creativity in solutions and approaches

MODEL QUESTION PAPER				
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY				
FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH AND YEAR				
Course Code: PBBCT406				
Course Name: Web Programming Lab				
Max. Marks: 40			Duration: 2 hours 30 minutes	
	PART A			
		Answer all questions. Each question carries 2 marks	CO	Marks
1		Define hyperlink with an example	CO 1	(2)
2		Expand the concept of Frames in HTML.	CO 1	(2)
3		Differentiate span tag and div tag	CO 2	(2)
4		Differentiate Selector Forms, Property-Value Forms	CO 2	(2)
5		What are JavaScript Functions and events?	CO 3	(2)
6		Describe any two JS Datatypes with examples.	CO 3	(2)
7		Distinguish between implode and explode function in PHP with suitable examples.	CO 4	(2)
8		What are associative arrays? How are associative arrays declared in PHP? Illustrate with an example.	CO 4	(2)
PART B				

<i>Answer any one full question from each module. Each question carries 6 marks</i>				
Module 1				
9	a)	Explain the basic syntax of HTML and describe the standard structure of an HTML document with an example.	CO 1	(6)
10	a)	What is the HTML DOM?	CO 1	(2)
	b)	Elaborate on the HTML5 <canvas> element and its use in web development?	CO 1	(4)
Module 2				
11	a)	List and explain any five font properties in CSS with examples.	CO 2	(6)
12	a)	Illustrate the CSS Box Model with its components	CO 2	(6)
Module 3				
13	a)	Explain any 3 operators in JS with examples.	CO 3	(6)
14	a)	Explain any 3 JS Objects with its use.	CO 3	(6)
Module 4				
	a)	Discuss the various steps for establishing PHP-MySQL connection with a MySQL database?	CO 4	(6)

1 5				
1 6	a)	Explain about XML Schema with an example	CO 4	(6)

SEMESTER 4

EXPLORATORY DATA ANALYSIS USING PYTHON

Course Code	BCPCL407	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:4:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. To introduce students to the essential techniques of exploratory data analysis (EDA) using Python
2. To familiarize students with data cleaning, visualization, and feature engineering
3. To equip students with the skills to summarize, understand, and interpret real-world datasets
4. To train students to perform in-depth analysis using Python libraries such as Pandas, Matplotlib, Seaborn, and others

Expt. No.	Experiments
1	Introduction to Python Libraries for Data Analysis(Pandas,NumPy,Matplotlib) You can use the Titanic dataset for practice: https://raw.githubusercontent.com/datasciencedojo/datasets/master/titanic.csv 1. Create a NumPy array with values from 1 to 50. Find its: Mean, Maximum, Minimum, Standard deviation 2. Load the Titanic dataset using NumPy Find: Number of passengers, Number of survivors, Average age 3.Using Matplotlib: 1. Plot a histogram of the Fare column in Titanic dataset. 2. Plot a bar chart showing the number of passengers by Pclass. 3. Plot a line chart showing numbers from 1 to 10 and their squares.
2	Data Importing and Basic Exploration Using Pandas 1. Load the Titanic dataset from the URL provided. 2. Print:

	Number of rows and columns Column data types Number of missing values in each column Basic descriptive statistics 3.Find: The number of passengers in each class The average age of passengers The number of survivors
3	Handling Missing Data and Data Imputation in Python (Pandas) 1 :Load the Titanic dataset. Display all columns with missing values and the % of missing data. 2 :Drop all rows where the Age is missing. Report the number of rows before and after. 3 :Impute missing Age with median. Impute missing Embarked with most frequent value (mode). Fill missing Cabin with a placeholder like "Unknown".
4	Data Transformation and Feature Engineering Using Python 1: Create a new feature FamilySize from SibSp and Parch. Create a binary column IsAlone (1 if alone, 0 otherwise). 2: One-hot encode the Sex and Embarked columns. Label encode the Pclass column. 3: Scale the Fare and Age columns using both: StandardScaler MinMaxScaler 4: Bin the Age column into categories: Child, Teen, Adult, Senior. Plot the average survival rate by age bin.
5	Descriptive Statistics and Summary of Data Create the dataset in CSV format with 20-30 realistic but fictional entries. For example : the required columns are :Student_ID (Unique identifier), Name (Student name), Gender (Male/Female/Other), Age (18-25), Department (CS/Commerce/Arts/Science), Semester (1-8), Attendance_Percentage (50-100), Hours_Studied_Per_Week (0-40), Midterm_Marks (0-100), Final_Marks (0-100), Has_Scholarship (Yes/No) Ensure some missing values in 2-3 columns. Intentionally include some outliers (e.g., one student with 50 hours studied) A) Display first 3 and last 3 records B) What are the data types of each column? C) How many missing values exist per column? D) What's the average age of students in Arts department? E) Compare mean midterm marks between scholarship/non-scholarship students F) Which department has the highest variance in final marks?
6	Data Visualization using Matplotlib and Seaborn(using same dataset as above or any customized dataset) 1. Histogram of attendance distribution 2. Boxplot comparing final marks across departments 3. Scatter plot of hours studied vs final marks 4. Is there any apparent relationship between study hours and marks?

	5. Which department has the most consistent performance (least spread)?
7	Correlation Analysis and Heatmaps (using same dataset as above or any customized dataset) 1. Create a correlation heatmap for numerical columns 2. Which two variables show strongest correlation? 3. Does attendance correlate with final marks?
8	Outlier Detection and Removal Techniques 1. Identify outliers in hours studied using IQR method 2. How would removing these affect the mean hours studied? 3. Should we keep the outlier? Justify your answer.
9	Univariate and Bivariate Analysis 1. Using the Titanic dataset: a. What is the distribution of passenger ages? b. What is the most common passenger class? 2. Analyze the relationship between Survived and Sex using a bar chart. What inference can you make? 3. How is the fare distributed across different passenger classes? Which class has the highest median fare?
10	Applying Advanced EDA Techniques: Boxplots, Violin Plots, etc. 1. Using the Titanic dataset: a. Create a boxplot to compare fares across passenger classes. b. What does the spread tell you? 2. Visualize age distribution across survival status using a violin plot. What patterns do you observe? 3.
11	Time Series Data Analysis and Visualization 1. Using a time series dataset (e.g., Johns Hopkins COVID dataset) a. Plot the daily trend of the target variable. b. What kind of pattern or seasonality do you observe? 2. How does grouping data by month or year help in understanding trends?
12	Final Project – Real World EDA Case Study 1. Choose a real-world dataset (minimum 10,000 rows) 2. Perform data loading, cleaning, and pre-processing 3. Conduct descriptive and inferential analysis 4. Create visualizations (basic and advanced)

	5. Apply feature engineering techniques 6. Identify patterns, trends, correlations, and outliers 7. Document all steps and insights in a report or presentation 8. Submit final report, code, and cleaned dataset
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Course Assessment Method (CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- *Endorsement by External Examiner: The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the importance of exploratory data analysis (EDA) in real-world data analysis.	K2
CO2	Use Python libraries like Pandas, Matplotlib, and Seaborn for data manipulation and visualization.	K3
CO3	Identify patterns, outliers, and key trends in datasets.	K3
CO4	Apply EDA techniques to solve problems in various domains	K3

	(business, healthcare, etc.).	
CO5		

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Python for Data Analysis	Wes McKinney	O'Reilly Media	3rd Edition, 2022
2	Hands-On Exploratory Data Analysis with Python	Suresh Kumar Mukhiya, Usman Ayyub Sheikh	Packt Publishing	1st Edition, 2020
3	Pandas for Everyone	Jake VanderPlas	O'Reilly Media	1st Edition, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Think Stats: Exploratory Data Analysis in Python	Allen B. Downey	Green Tea Press	2nd Edition, 2014
2	Data Science from Scratch	Joel Grus	O'Reilly Media	2nd Edition, 2019

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.swayam2.ac.in/ini25_cs04/
2	https://onlinecourses.nptel.ac.in/noc25_cs104/

Continuous Assessment (25 Marks)

5. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

6. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

7. Lab Reports and Record Keeping (6 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

8. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

6. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

7. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

8. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

9. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

10. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted