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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

QUESTION BANK

II YEAR

SEMESTER –IV

ACADEMIC YEAR: 2025 – 2026

INDEX

HEAD OF THE DEPARTMENT

IQAC DIRECTOR **PRINCIPAL** **CHAIRMAN**

24MABS404- PROBABILITY AND STATISTICS

UNIT – 1 : PROBABILITY AND RANDOM VARIABLES

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State the axioms of probability.	CO1	RE	2
2.	Find C, if a continuous random variable X has the density function $f(x)=\frac{c}{1+x^2}$, $-\infty<x<\infty$.	CO1	UN	2
3.	A continuous random variable X that can assume any value between x=2 and x=5 has a density function given by f(x)= (2/27)(1+x). Find P(X<4).	CO1	UN	2
4.	Show that $M_{X+Y}(t) = M_X(t) . M_Y(t)$ where X and Y are two independent random variables.	CO1	RE	2
5.	If the moment generating function of a random variable X is, $\frac{1}{1-t}, \lvert t\rvert < 1$, find $E(X)$ and $E(X^2)$.	CO1	UN	2
6.	The mean of Binomial distribution is 20 and standard deviation is 4. Find the parameters of this distribution.	CO1	UN	2
7.	What are the limitations of Poisson distribution?	CO1	RE	2
8.	A random variable X is uniformly distributed between 3 and 15. Find the variance of X.	CO1	UN	2
9.	If the random variable has the mgf $M_x(t)=\frac{2}{2-t}$, determine the variance of X.	CO1	UN	2
10.	Write down the pdf of Normal Distribution.	CO1	UN	2
	PART B			
1.	A random variable X has the following probability distribution	CO1	AP	16

x	0	1	2	3	4	5	6	7
P(X=x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

Determine (i) the value of K (ii)P(X<6), P(1<X<5), P(X≥6) and (iii)If P[X≤C]>1/2, then find the minimum value of C.

2.	If the random variable X has the probability values {1,2,3,4} such that	CO1	AP	16

	2P(X=1)=3P(x=2)=P(X=3)=5P(X=4). Find the probability distribution and Cummulative distribution of X.			
3.	(i) Estimate the moment generating function of a random variable X whose probability function $P(X = x) = \frac{1}{2^x}, x = 1,2, \ldots$ Hence find its mean.	CO1	AP	8
	(ii) A continuous random variable X has the density function f(x) given by $P(X = x) = \frac{k}{x^2 + 1}, -\infty < x < \infty$. Find the value of 'k' and the cumulative distribution of X.			8
4.	(i) In a large consignment of electric lamps, 5% are defective. A random sample of 8 lamps is taken for inspection. What is the probability that it has one or more defective? (ii) One percent of jobs arriving at a computer system need to wait until weekends for scheduling, owing to core-size limitations. Find the probability that among a sample of 200 jobs there are no jobs that have to wait until weekends.	CO1	AP	16
5.	(i)Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) at least 1 boy (iii)at most 2 girls and (iv) children of both genders. Assume equal probabilities for boys and girls. (ii)State and prove memory less property of Geometric distribution.	CO1	AP	16
6.	(i)The mileage which car owners get with a certain kind of radial tire is a random variable having an exponential distribution with mean 40,000 km. Find the probability that one of these tires will last atleast 20,000 km. Also find the probability that one of these tires will last at most 30,000 km. (ii) An electrical firm manufactures light bulbs that have a life before burn-out that is normally distributed with mean equal to 800 hrs and a S.D. of 40 hrs. Determine (a) the probability that a bulb burns more than 834 hrs(b)the probability that a bulb burns between 778 and 834 hrs.	CO1	AP	16

UNIT II-TWO- DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Let X and Y be two independent R.V.s with Var(X)=9 and Var(Y)=3. Find Var(4X-2Y+6).	CO2	UN	2
2.	The joint probability mass function of (X, Y) is given by $p(x,y) = k(2x+y), x = 1,2$ and y=1,2 where k is a constant. Find the value of k.	CO2	UN	2
3.	The joint p.d.f. of the random variable X and Y is defined as $f(x,y) = \begin{cases} 25e^{-5y}, & 0 < x < 0.2,\ y > 0 \\ 0 & otherwise \end{cases}$. Find the marginal p.d.f.'s of X and Y.	CO2	UN	2
4.	The joint p.d.f. of the random variable X and Y is defined as $f(x,y) = \begin{cases} 1/4, & 0 \le x, y \le 2 \\ 0 & otherwise \end{cases}$. Find P(x+y≤1).	CO2	UN	2
5.	Find the covariance of X and Y if the joint probability density function is $\mathbf{f(x,y) = 1,\ 0 < x < 1 \ \&\ 0 < y < 1}$	CO2	UN	2
6.	If X and Y are independent random variables prove that Cov(X, Y) = 0.	CO2	UN	2
7.	The regression equations are x+9y = 7 and y+4x = 49/3. Find the correlation coefficient between X and Y.	CO2	UN	2
8.	Can $y = 5 + 2.8x$ and $x = 3 - 0.5y$ be the estimated regression equation of y on x respectively explain your answer.	CO2	UN	2
9.	Write any two properties of regression coefficients.	CO2	UN	2
10.	If X and Y are independent, what is f(x,y)?	CO2	UN	2
	PART B			
1.	The joint probability mass function of (X, Y) is given by $p(x,y) = k(2x+3y)$ $x = 0,1,2;\ y = 1,2,3$. Determine all the marginal and conditional probability distributions. Also find the probability distribution of (X+Y) and P(X+Y>3).	CO2	AN	16

2. The joint p.d.f. of the R.V. (X,Y) is given by CO2 AP 16

$$f(x,y)=\begin{cases}\frac{1}{8}(6-x-y)\ , & 0<x<2,\ 2<y<4\\ 0 & otherwise\end{cases}.$$

Estimate (i) P(X < 1 ∩ Y < 3) (ii) P(X + Y < 3) (iii) P (X < 1 / Y < 3).

3. From the following data estimate (a) the two regression equations (b) the coefficient of correlation between the marks in economics and statistics. (c) the most likely marks in statistics when marks in economics are 30. CO2 AP 16

x	25	28	35	32	31	36	29	38	34
y	43	46	49	41	36	32	31	30	33

4. The equation of two regression lines are $8x-10y+66=0$ and $40x-18y-214=0$. Find $\bar{x}$, $\bar{y}$ and the correlation co-efficient between X and Y. CO2 AN 16

5. The joint probability mass function of X and Y is given below. Find the Correlation coefficient of (X,Y) CO2 AN 16

Y \ X	-1	+1
0	1/8	3/8
1	2/8	28

6. Find the correlation co-efficient from the following data: CO2 AN 16

Rank in X	1	2	3	4	5	6
Rank in Y	4	3	1	2	6	5

UNIT III- ESTIMATION THEORY

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments -Method of maximum Likelihood - Interval estimation of Means - Differences between means,variations and ratio of two variances.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Write the difference between Point Estimate and Interval Estimate of population parameters.	CO3	RE	2
2.	What are the characteristics that should be satisfied by a good estimator?	CO3	RE	2
3.	If X has the binomial distribution with parameters n and θ, show that the sample proportion X/n is an unbiased estimator of θ.	CO3	RE	2
4.	What are the commonly used methods of Point Estimation?	CO3	RE	2
5.	Define Population Estimation.	CO3	RE	2
6.	What is called interval estimation?	CO3	RE	2
7.	Define unbiased estimator.	CO3	RE	2
8.	Define maximum likelihood estimator of θ.	CO3	RE	2
9.	Mention the properties of the maximum likelihood estimator.	CO3	RE	2
10.	What are the criteria's that a good point estimator should satisfy?	CO3	RE	2
	PART B			
1.	(i) Show that the sample mean $\overline{x}$ is an unbiased estimator for the population mean μ. (ii) If $\{x_1, x_2, \ldots, x_n\}$is a random sample of size n, drawn from a geometric distribution, the probability mass function of which is given by $P(x = r) = pq^{r-1}$; $r = 1,2,3, \ldots, \infty$. Prove that the mean of the sample is a consistent estimator of the population mean.	CO3	UN	8 8
2.	Find the maximum likelihood estimator for the parameter P of the binomial distribution$B(N, P)$, where N is very large but finite, on the basis of sample size n. Also find its variance.	CO3	AN	16
3.	A research worker wants to determine the average time it takes a mechanic to rotate the tyres of a car and he wants to be able to assert with 95% confidence that the mean of his sample is of by atmost 0.5 minutes. If he can presume from past experience that $\sigma = 1.6$ minutes, how large a sample will have to take?	CO3	AN	16

4.	The average monthly electricity consumption for a sample of 100 families is 1250 units. Assuming the standard deviation of electric consumption of all families is 150 units, construct a 95% confidence interval estimate of the actual mean electric consumption.	CO3	AN	16
5.	In a test given to two groups of students the marks obtained were as follows: Construct a 95% confidence interval on the mean marks secured by students of the above two groups.	CO3	AN	16

I group	18	20	36	50	49	36	34	49	61
II group	29	28	26	35	30	44	46		

6.	Construct a 94% confidence interval for the difference between the mean-life time of two kinds of light bulbs, given that a random sample of 40 light bulbs of the first kind lasted on the average 418 hours of continuous use and 50 light bulbs of the second kind lasted on the average 402 hours of continuous use. The population S.D are known to be 26 and 22.	CO3	AN	16

UNIT IV

NON-PARAMETRIC TESTS

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test- Tests based on Runs - Test of randomness - The Kolmogorov Tests .

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Name four non – parametric tests used in statistical study.	CO4	RE	2
2.	Write any two advantages of non – parametric methods over parametric methods.	CO4	RE	2
3.	State the limitations of non – parametric test.	CO4	RE	2
4.	Distinguish between the Mann-Whitney U-test and the Kruskal-Wallis.	CO4	RE	2
5.	Write the formula for Kruskal-Wallis test.	CO4	RE	2
6.	Explain run test with an example	CO4	RE	2
7.	What are the uses of run test?	CO4	RE	2
8.	What are the assumptions of the Mann-Whitney?	CO4	RE	2

9.	Write any two differences of non-parametric methods and parametric methods?	CO4	RE	2
10.	What is Friedman test?	CO4	RE	2

PART B

1.	In a factory, 20 observations of the factors that could heat up a conveyor belt yielded the following results : 0.36, 0.41, 0.25, 0.34, 0.28, 0.26, 0.39, 0.28, 0.40, 0.26, 0.35, 0.38, 0.29, 0.42, 0.37, 0.37, 0.39, 0.32, 0.29 and 0.36. Use the sign test at the 0.01 level of significance to test the null hypothesis $\mu = 0.34$ against the alternative hypothesis $\mu \neq 0.34$.	CO4	AP	16
2.	The following are the average weekly losses of worker-hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation. Use the sign test at the 0.05 level of significance to test whether the safety program is effective.	CO4	AP	16

Before :	45	73	46	124	33	57	83	34	26	17
After :	36	60	44	119	35	51	77	29	24	11

3.	Drop in diastolic blood pressure (in mm mercury)	CO4	AP	16

Drug 1	10	16	10	4	2	14	4
Drug 2	33	34	41	36	42	42	32

Test whether there is any difference in the effectiveness of drugs at $\alpha = 0.05$. Using Wilcoxon's signed rank test. (Table value for n=7 is 2)

4.	Two classes of students are tested using a certain competitive exam. The scores of a sample of students from each class is given below:	CO4	AP	16

Class A	45	44	47	48	55	53	55	63			
Class b	65	67	77	65	56	67	78	55	66	65	58

Use Mann Whitney – U test to test whether both classes have similar scholastic levels.

5.	An experiment designed to compare three preventative methods against corrosion yielded the following maximum depths of pits (in thousands of an inch) in pieces of wire subjected to the respective treatments.	CO4	AP	16

Method A	77	54	67	74	71	66	
Method B	60	41	59	65	62	64	52

Method C	49	52	69	47	56		

6.	Use the Kruskal-Wallis test at the 5% level of significance to test the null hypothesis that the three samples come from identical populations. A technician is asked to analyze the results of 22 items made in a preparation run. Each item has been measured and compared to engineering specifications. The order of acceptance 'a' and rejections 'r' is aa rrr a rr aaaaa rr a rr aa r a Determine whether it is a random sample or not. (Use $= 0.05$).	CO4	AP	16

UNIT V

STATISTICAL QUALITY CONTROL

Control charts for measurements (*X* and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Statistical Quality Control and state its objectives.	CO5	RE	2
2	State the benefits of statistical Quality Control.	CO5	RE	2
3.	Define control charts.	CO5	RE	2
4.	Classify control charts.	CO5	RE	2
5.	Define defect and defective.	CO5	RE	2
6.	Define mean chart.	CO5	RE	2
7.	Define R Chart.	CO5	RE	2
8.	Write the control limits for the R chart.	CO5	UN	2
9.	Explain the construction of R-chart	CO5	UN	2
10.	What are the commonly used control charts?	CO5	UN	2

PART B

1. The following are the sample means and ranges for ten samples, each of size 5. Construct the control chart for mean and range and comment on the nature of control. CO5 AP 16

Sample No.	1	2	3	4	5	6	7	8	9
Mean	12.8	13.1	13.5	12.9	13.2	14.1	12.1	15.5	13.9
Range	2.1	3.1	3.9	2.1	1.9	3.0	2.5	2.8	2.5

2. The values of sample mean $\overline{X}$ and sample standard deviation s for 15 samples, each of size 4, drawn from a production process are given below. Draw the appropriate control charts for the process average and process variability. Comment on the state of control. CO5 AP 16

Sample No.	1	2	3	4	5	6	7	8	9
Mean	15	10	12.5	13	12.5	13	13.5	11.5	1
S.D.	3.1	2.4	3.6	2.3	5.2	5.4	6.2	4.3	3.

Sample No.	10	11	12	13	14	15
Mean	13	14.5	9.5	12	10.5	11.5
S.D.	4.1	3.9	5.1	4.7	3.3	3.3

3. 20 pieces of cloth out of different rolls contained respectively 1, 4, 3, 2, 4, 5, 6, 7, 2, 3, 2, 5, 7, 6, 4, 5, 2, 1, 3 and 8 imperfections. Ascertain whether the process is in a state of statistical control. CO5 AP 16

4. 15 tape – recorders were examined for quality control test. The number of defects in each tape – recorder below. Draw the appropriate control chart and comment on the state of control. CO5 AP 16

Unit No.(i)	1	2	3	4	5	6	7	8
No. of defects	2	4	3	1	1	2	5	3

Sample No.	10	11	12	13	14	15
No. of defects(c)	7	3	1	4	2	1

5. The data given below are the number of defectives in 10 samples of 100 items each. Construct a p-chart and an np-chart and comment on the results : CO5 AP 16

Sample No.	1	2	3	4	5	6	7	8	9
No. of defectives	6	16	7	3	8	12	7	11	11

6. The table given below gives the measurements obtained in 10 samples. Construct control charts for mean and range. Discuss the nature of control. CO5 AP 16

Sample	1	2	3	4	5	6	7	8	9
Measure-ments in X	62	50	67	64	49	63	61	63	48
	68	58	70	62	98	75	71	72	79
	66	52	68	57	65	62	66	61	53
	68	58	56	62	69	58	69	53	61
	73	65	61	63	66	68	77	55	49
	68	66	66	74	64	55	53	57	56

24CSPC403-OPERATING SYSTEM

UNIT I - INTRODUCTION

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

Q.No	Question	CO	BTL	Marks
PART A				
1.	What are the objectives of operating systems?	CO1	RE	2
2.	List the Services of operating system function.	CO1	RE	2
3.	Compare between Monolithic & Microlithic.	CO1	UN	2
4.	What is Boot strapping?	CO1	RE	2
5.	How does timesharing differ from Multiprogramming?	CO1	AN	2
6.	Summarize the difference between DMA andcache memory.	CO1	UN	2
7.	How does an interrupt differ from a trap?	CO1	AN	2
8.	Why is API needed to be used rather than system calls?	CO1	AN	2
9.	Define a system call.	CO1	RE	2

10.	List the advantages of peer-to-peer systems over client-server systems?	CO1	RE	2

PART B

1.	Analyze the basic computer system architecture and justify the role of each component in efficient operating system functioning with a neat diagram.	CO1	AN	16
2.	Explain the purpose of system calls and discuss the calls related to device management and communications in brief	CO1	AN	16
3.	Write short notes on operating system services and components.	CO1	UN	16
4.	Discuss the essential properties of the following types of systems (i) Time sharing systems. (ii) Multi-programmed batch systems.	CO1	AN	16
5	Analyze multiprocessor systems and compare the different types based on performance, scalability and reliability	CO1	AN	16
6	Analyze different operating system structures and examine the role of system calls and system programs in supporting these structures with suitable illustrations	CO1	AN	16

UNIT II
PROCESS MANAGEMENT

Processes – Process Concept – Process Scheduling – Operations on Processes – Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define the term process and explain the process states	CO2	RE	2
2.	Outline the concept of Process Control Block (PCB) and its purpose in an operating system.	CO2	UN	2
3.	What is meant by context switching?	CO2	RE	2
4.	What is critical section problem?	CO2	RE	2
5.	Relate single threaded and multi-threaded processes	CO2	UN	2
6.	Define busy waiting and spinlock.	CO2	RE	2
7.	What are the various scheduling criteria for CPU scheduling?	CO2	RE	2
8.	Explain the concept of the Critical Section Problem in operating systems	CO2	UN	2
9.	Recall the schemes used to handle deadlock	CO2	RE	2
10.	What is a resource-allocation graph and list its applications.	CO2	RE	2
	PART B			
1.	Consider the following set of processes with the length of the CPU- burst time in given ms: Process Arrival Time Burst Time P1 0 8 P2 1 4 P3 2 9 P4 3 5 P5 4 3 Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, priority and RR(quantum=2)scheduling. Also calculate waiting time and	CO2	AN	16

turnaround time for each scheduling algorithms.

2.	Analyze and compare short-term, medium-term and long-term schedulers with suitable examples, highlighting their roles in process management.	CO2	AN	16
3.	(i). Discuss the actions taken by a kernel to context-switch between processes.			8
	(ii) Describe PCB. Explain the process state transition diagram**.**	CO2	AN	8
4.	Explain in detail the classical synchronization problems: Producer–Consumer problem, Readers–Writers problem, and Dining Philosophers problem. Discuss the issues involved and their solutions using semaphores.	CO2	AN	16
5.	Explain Deadlock detection with suitable example.	CO2	AN	16

	Max	**Allocation**	**Available**	**Need**
	ABCD	**ABCD**	**ABCD**	**ABCD**
P0	6 0 1 2	4 0 0 1	3 2 1 1	
P1	1 7 5 0	1 1 0 0		
P2	2 3 5 6	1 2 5 4		
P3	**1 6 5 3**	0 6 3 3		
P4	1 6 5 6	0 2 1 2		

Consider the following system snapshot using data structures in the Banker's algorithm with resources A,B,C and D and process P0 to P4:

6.	Using Banker's algorithm, answer the following questions: (i) How many resources of type A,B,C and D are there? (ii) What are the contents of the need matrix? (iii) Is the system in a safe state? Why? (iv) If a request from process P4 arrives for additional resources of (1,2,0,0) can the banker's algorithm grant the request immediately? Show the new system state and other criteria.	CO2	AN	4 4 4 4

UNIT III MEMORY MANAGEMENT

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Distinguish between paging and segmentation	CO3	UN	2
2.	Illustrate the concepts of hit and miss in paging.	CO3	UN	2
3.	What is meant by address binding? Mention the different types.	CO3	RE	2
4.	What is contiguous memory allocation?	CO3	RE	2
5.	What is swapping in memory management?.	CO3	RE	2
6.	How the problem of internal fragmentation can be solved?	CO3	UN	2
7.	Define demand paging in memory management.	CO3	RE	2
8.	State the significance of LDT and GDT in segmentation.	CO3	UN	2
9	When is page replacement algorithm needed?	CO3	RE	2
10	What is thrashing? How to resolve this problem?	CO3	RE	2
	PART B			
1.	Explain main memory management in detail with necessary diagram.	CO3	UN	16
2.	Analyze scenarios in which the FIFO page replacement algorithm better than LRU and justify your answer.	CO3	AN	16
3.	Given memory partitions of 100KB, 500KB, 200KB, 300KB and 600KB(in order), how would each of the first-fit, best-fit and worst-fit algorithms place processes of 212KB, 417KB, 112KB and 426KB(in order)? Which algorithm makes the most efficient use of memory?	CO3	AN	16
4.	Consider the following page reference string: 1, 2, 3, 4, 5, 3,4,1,6,7,8,7, 8, 9, 7, 8, 9, 5, 4, 4, 5, 3 How many page faults would occur for the following replacement algorithms, assuming four frames? Remembering all frames are initially empty. (i) LRU replacement (ii) FIFO replacement (iii) Optimal replacement.	CO3	AN	16
5.	Explain when page faults will occur? Describe the actions taken by operating system during page fault.	CO3	UN	16
6.	Draw the diagram of segmentation memory management scheme and explain its principle.	CO3	AN	16

UNIT IV

STORAGE MANAGEMENT

Mass Storage system – Disk Structure – Disk Scheduling and Management; File-System Interface-File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define a mass storage system and state how it differs from primary memory.	CO4	UN	2
2.	What are the various file operations?	CO4	RE	2
3.	State the role of index files in direct access files.	CO4	UN	2
4.	Differentiate the various file access methods.	CO4	UN	2
5.	Define seek time and latency time.	CO4	RE	2
6.	Differentiate between file and directory.	CO4	RE	2
7.	Write Short notes on file system mounting.	CO4	UN	2
8.	What are the various Disk-Scheduling Algorithms?	CO4	RE	2
9	What is garbage collection?	CO4	RE	2
10	What is meant by polling?	CO4	RE	2
	PART B			
1.	Analyze the different disk scheduling algorithms with examples	CO4	AN	16
2.	Compare and contrast FCFS, SSTF, C-SCAN and C-LOOK disk scheduling algorithms with own examples.	CO4	UN	16
3.	Explain about RAID structure in disk management with various RAID levels of organization in detail	CO4	UN	16
4.	On a disk with 200 cylinders, numbered 0 to 199, compute the number of tracks the disk arm must move to satisfy the entire request in the disk queue. Assume the last request received was at truck 100. The queue in FIFO order contains requests for the following tracks. 55, 58, 39, 18, 90, 160, 150, 38, 184. Perform the computation to find the seek time for the following disk scheduling algorithms. (i) FCFS (ii)SSTF (iii) SCAN (iv) C-SCAN (v) LOOK	CO4	AN	16
5.	Analyze the File system implementation	CO4	AN	16
6.	Analyze disk allocation methods and evaluate disk management procedures with respect to performance and reliability.	CO4	AN	16

UNIT V
VIRTUAL MACHINES AND MOBILE OS

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the advantages of Linux OS	CO5	RE	2
2.	What is process Identity?	CO5	RE	2
3.	Define DNS	CO5	RE	2
4.	What is virtualization?	CO5	RE	2
5.	What is the use of firewall manager	CO5	RE	2
6.	State the components of a Linux System?	CO5	RE	2
7.	Mention any two features of Linux file systems.	CO5	RE	2
8.	What scheduling algorithm is used in linux operating system to schedule jobs?	CO5	RE	2
9	What are the Components of a Linux System?	CO5	RE	2
10	What is handle? How does a process obtain a handle?	CO5	RE	2
	PART B			
1.	Illustrate in detail about LINUX multifunction server, DNS VMware on LINUX host.	CO5	UN	16
2.	Outline the significance and steps involved in setting up Xen, VMware software‘s on Linux host for successful virtualization in detail	CO5	UN	16
3.	(i) Explain the components of Linux system with neat sketch.	CO5	AN	8
	(ii) Write the various system administrator roles in LINUX OS.			8
4.	Examine the step-by-step procedure for setting up a Linux multifunction server and evaluate their importance	CO5	AN	16
5.	Explain the architecture of iOS. Discuss the media and service layers clearly.	CO5	AN	16
6.	Explain in detail about LINUX multifunction server, DNS VMware on LINUX host.	CO5	AN	16

24AIPC401-MACHINE LEARNING

UNIT I

INTRODUCTION TO MACHINE LEARNING

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define machine learning.	CO1	UN	2
2.	What does a matrix represent and what its importance in machine learning?	CO1	UN	2
3.	Outline vector and how it is used in machine learning.	CO1	UN	2
4.	List two motivations for using machine learning.	CO1	RE	2
5.	Identify any two real-world applications of machine learning.	CO1	RE	2
6.	Recall any two assumptions in PAC learning.	CO1	RE	2
7.	Define hypothesis space in machine learning.	CO1	RE	2
8.	How machine learning is used in fraud detection.	CO1	UN	2
9.	What does a high VC dimension indicate about a hypothesis class?	CO1	UN	2
10.	Outline generalization in machine learning.	CO1	UN	2
	PART B			
1.	(i) Compare traditional programming and machine learning paradigms. (ii) Explain the motivation and need for machine learning.	CO1	UN	8 8
2.	Apply linear algebra concepts to explain learning algorithms in machine learning.	CO1	AP	16
3.	Explain the Vapnik-Chervonenkis (VC) dimension and its significance in machine learning.	CO1	UN	16
4.	Illustrate the PAC learning framework with assumptions and examples.	CO1	AP	16
5.	Analyze the role of hypothesis space and inductive bias in learning.	CO1	AN	16
6.	Analyze the Bias–Variance Trade-off and its impact on Generalization.	CO1	AN	16

UNIT II

SUPERVISED LEARNING

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

Q.No	Question	CO	BTL	Marks
	PART A			
1.	State the objective of the least squares method.	CO2	RE	2
2.	Differentiate between single variable and multiple variable linear regression.	CO2	UN	2
3.	Define gradient descent.	CO2	RE	2
4.	Outline why logistic regression is called a probabilistic discriminative model.	CO2	UN	2
5.	Compare the Perceptron algorithm with logistic regression.	CO2	UN	2
6.	Outline why logistic regression is called a probabilistic discriminative model.	CO2	UN	2
7.	List any two advantages of Naïve Bayes classifier.	CO2	RE	2
8.	Define Random Forest classifier.	CO2	RE	2
9.	State the purpose of splitting criteria in decision trees.	CO2	RE	2
10.	Outline how Random Forest reduces overfitting.	CO2	UN	2
	PART B			
1.	Discuss the fundamentals of linear regression models. Describe how gradient descent is used for model training.	CO2	UN	8 8
2.	Analyze Bayesian Linear Regression and compare Bayesian linear regression with ordinary least squares regression.	CO2	AN	16
3.	Illustrate the logistic regression model and derive its cost function.	CO2	AP	16
4.	Compare Naïve Bayes, Logistic Regression, and Support Vector Machines for classification.	CO2	AN	16
5.	Demonstrate the steps involved in constructing a decision tree classifier using an example.	CO2	AP	16
6.	Explain Random Forest algorithm in detail.	CO2	UN	16

UNIT III

ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization - Evaluation Metrics - ROC curves – Evaluation

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define ensemble learning.	CO3	RE	2
2.	Differentiate between bagging and boosting.	CO3	UN	2
3.	Outline the working principle of stacking.	CO3	UN	2
4.	Recall the objective function used in K-means clustering.	CO3	RE	2
5.	State one situation where K-means performs poorly.	CO3	RE	2
6.	Outline how classification is performed using KNN.	CO3	UN	2
7.	List two limitations of KNN algorithm.	CO3	RE	2
8.	Define Gaussian Mixture Model (GMM).	CO3	RE	2
9.	Outline how an ROC curve is constructed.	CO3	UN	2
10.	Interpret the relationship between True Positive Rate and False Positive Rate in an ROC curve.	CO3	UN	2
	PART B			
1.	Analyze ensemble learning techniques such as bagging, boosting, and stacking.	CO3	AN	16
2.	Explain K-means clustering algorithm with step-by-step illustration.	CO3	UN	16
3.	Apply KNN algorithm for classification using distance metrics.	CO3	AP	16
4.	Compare K-means clustering and Gaussian Mixture Models.	CO3	AN	16
5.	Explain evaluation metrics used in machine learning classification problems.	CO3	UN	16
6.	Analyze how the ROC curve is used to evaluate the performance of a classifier.	CO3	AN	16

UNIT IV

NEURAL NETWORKS

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define a Multilayer Perceptron (MLP).	CO4	RE	2
2.	List any two commonly used activation functions.	CO4	RE	2
3.	Outline the purpose of activation functions in neural networks.	CO4	UN	2
4.	Differentiate between batch gradient descent and stochastic gradient descent.	CO4	UN	2
5.	Compare shallow and deep network.	CO4	UN	2
6.	Define vanishing gradient problem.	CO4	RE	2
7.	List two advantages of ReLU over sigmoid.	CO4	RE	2
8.	Why is hyperparameter tuning important for model performance?	CO4	UN	2
9.	Outline the purpose of batch normalization.	CO4	UN	2
10.	What is the need for regularization in deep neural networks?	CO4	UN	2
	PART B			
1.	Explain the architecture and functioning of a Multilayer Perceptron (MLP).	CO4	UN	16
2.	Compare and analyze gradient descent and stochastic gradient descent in terms of convergence speed, stability, and scalability.	CO4	AN	16
3.	Explain the flowchart for back propagation network training process. Find the new weight after the first iteration, network is presented with input 0.5 and 0.8 and target output 1. Use learning rate 0.1 and sigmoidal activation function. The initial weights are [w11, w21, w12, w22] = [0.1, 0.2, 0.3, 0.4] output weights [w1, w2] = [0.6, 0.7] Biases: hidden bias b1=0.25 and output bias b2=0.35.	CO4	UN	16
4.	Explain hyperparameter tuning in neural networks. Discuss different methods for optimizing hyperparameter.	CO4	AN	16

5.	Explain batch normalization and demonstrate its use by normalizing a mini batch (2,4,6,8}. Interpret the result	CO4	AN	16
6.	Analyze different regularization techniques used in neural networks.	CO4		16

UNIT V

MACHINE LEARNING IN PRACTICE

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms, Data Collection- Preprocessing (Missing Values, Normalization, Adopting to chosen algorithm) Outlier Analysis (Z-Score)

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define the term machine learning experiment and state its purpose.	CO5	RE	2
2.	List any two standard guidelines followed while designing machine learning experiments.	CO5	RE	2
3.	Define cross validation in the context of machine learning.	CO5	RE	2
4.	Outline the working principle of K-fold cross validation.	CO5	UN	2
5.	List any two commonly used performance metrics for classification models.	CO5	RE	2
6.	Compare missing value imputation and data deletion.	CO5	UN	2
7.	State data preprocessing in machine learning.	CO5	RE	2
8.	Interpret how a confusion matrix is used to assess a classifier.	CO5	UN	2
9.	Outline the purpose of normalization in data preprocessing.	CO5	UN	2
10.	Interpret the significance of Z-score threshold values in outlier detection.	CO5	UN	2
	PART B			
1.	Explain the guidelines for conducting machine learning experiments with suitable examples.	CO5	UN	16
2.	Analyze the working of K-fold cross validation with a neat diagram and discuss the effect of different values of *K* on bias and variance.	CO5	AN	16
3.	Explain the concept of bootstrapping and apply the bootstrapping technique to a dataset {10,20,30,40} and compute the mean for at least 4 bootstrap samples.	CO5	AP	16

4.	Apply appropriate performance measures for a classification model, Given TP=60, TN=50, FP=15, FN=5 (i) Construct the confusion matrix and apply formulas to find accuracy, precision, recalls and F1 score. (ii) Determine which error (FP or FN) is minimized.	CO5	AP	16
5.	Explain preprocessing techniques with examples.	CO5	UN	16
6.	Examine the Z-score method for outlier detection and analyze the significance of threshold value.	CO5	AN	16

24AIPC403

COMPUTER NETWORKS AND SECURITY

UNIT I-DATA COMMUNICATIONS AND PHYSICAL LAYER

Introduction, networks topologies, ISO/OSI model, TCP / IP model and protocols, Performance Metrics- Different types of transmission media, errors in transmission: attenuation, noise- Repeaters- Encoding (NRZ, NRZI, Manchester, 4B/5B), Networking Devices: Hubs, Bridges, Switches, Routers and Gateways- Switching-Circuit Switched Networks-Packet Switched Networks-Introduction to sockets

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List the three fundamental characteristics determine the effectiveness of a data communication system.	CO1	RE	2
2.	Define transmission modes.	CO1	RE	2
3.	For n devices in a network, what is the number of cable links required for a mesh, ring, bus and star topology?	CO1	UN	2
4.	Enumerate the three criteria necessary for and effective and efficient network.	CO1	RE	2
5.	State network topology and list its types.	CO1	RE	2
6.	List the five components of data communications system.	CO1	RE	2
7.	The power of the signal is 10mW and the power of the noise is 1μW, What are the values of SNR and SNR dB ?	CO1	AN	2
8.	Infer the responsibilities of network layer in the ISO-OSI model.	CO1	RE	2
9.	Draw the graph for NRZ-L, NRZ-I scheme for the data streams. 001101011	CO1	AN	2
10.	Define socket.	CO1	RE	2
	PART B			
1.	Illustrate the OSI network architecture and explain the functionalities of each layer in detail.	CO1	UN	16
2.	Explain in detail about the TCP/IP protocol suite with neat diagram	CO1	UN	16
3.	Illustrate the different types of transmission medias in detail.	CO1	UN	16
4.	Apply the concept of network topologies to design a suitable network for a medium - sized organization and justify the choice of topology with respect to performance and reliability.	CO1	AN	16
5.	Apply the concept of different types of networks to classify and explain LAN, MAN, and WAN with suitable diagrams.	CO1	AN	16
6.	Analyze and compare circuit-switched networks and packet-switched networks with respect to delay, bandwidth utilization, and reliability.	CO1	AP	16

UNIT II

DATALINK LAYER

Addressing, Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth,HDLC,PPP.MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List out the functions of Data Link layer.	CO2	RE	2
2.	State the purpose of error detection in data communication.	CO2	RE	2
3.	Find the hamming distance between the two pair of code words: A = 01011; B = 11110	CO2	UN	2
4.	What are the two types of errors occurred during data transmission?	CO2	RE	2
5.	State any two advantages of Hamming code.	CO2	UN	2
6.	Differentiate Stop-and-Wait protocol and Sliding Window protocol.	CO2	UN	2
7.	Identify the access method used in Ethernet.	CO2	RE	2
8.	Infer any two features of Gigabit Ethernet.	CO2	UN	2
9.	State the reason why Token Ring does not experience data collision.	CO2	RE	2
10.	Define CSMA/CD	CO2	RE	2
	PART B			
1.	The message 11001001 is to be transmitted, using CRC error detection algorithm. Assuming the CRC polynomial to be $X^3 + X^2 + 1$, determine the three-bit CRC code that should be appended to message.	CO2	AN	16
2.	Explain various flow control mechanisms. i) Stop Wait protocol ii) Go Back-N iii) Selective Repeat	CO2	UN	16
3.	Discuss in detail about PPP protocol.	CO2	UN	16
4.	Analyze the evolution of Ethernet to Gigabit Ethernet in terms of data rate, transmission media, frame format and applications.	CO2	AP	16
5.	Apply the concept of Bluetooth technology to explain its architecture, protocol stack, applications and also analyze its suitability for short range communication.	CO2	AN	16
6.	Analyze the operation of CSMA/CD and CSMA/CA protocols and evaluate their effectiveness in wired and wireless LAN	CO2	AP	16

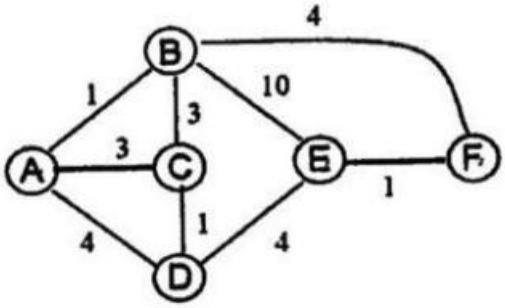
environments.

UNIT III

NETWORK LAYER

Internet Protocol, IPv4,IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, Network Address Translation

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define Internet Protocol and state its function.	CO3	RE	2
2.	State any two functions of IPv4.	CO3	RE	2
3.	Identify the role of DHCP in IP address allocation.	CO3	RE	2
4.	Differentiate Distance Vector Routing and Link State Routing.	CO3	UN	2
5.	Identify the class of the following IP address: a) 110.34.56.45 b) 127.1.1.1 c) 212.208.63.23 d) 255.255.255.255	CO3	UN	2
6.	Differentiate classless addressing and classful addressing.	CO3	UN	2
7.	Infer the need of ARP protocol.	CO3	UN	2
8.	Define subnetting.	CO3	RE	2
9.	State the benefits of Open Shortest Path First(OSPF) protocol.	CO3	RE	2
10.	Apply NAT to state how it helps conserving IPv4 addresses.	CO3	AN	2
	PART B			
1.	An ISP is given a block of addresses beginning with 190.100.0.0/16. The ISP needs to distribute these addresses to 3 groups of customers as follows: a) Group 1 has 64 customers each needs 256 addresses. b) Group 2 has 128 customers each needs 128 addresses. c) Group 3 has 128 customers each needs 64 addresses. Design the sub-blocks and give the slash notation for each sub-block. How many addresses are still available after these allocations?	CO1	AN	16
2.	Explain about IPv6 datagram format with suitable diagram.	CO2	UN	16

3.	Describe in detail about ARP operation, packet format and the situations when the ARP services are used.	CO3	UN	16
4.	Discuss in detail about the Internet Control Message Protocol (ICMP) with a neat diagram.	CO4	UN	16
5.	Consider the network shown below. Show the operation of Dijikstra's (Link State) algorithm for computing the least cost path from router F to all destinations. Explain the process. 	CO5	AN	16
6.	Analyze how two routers exchange routing information using the BGP protocol, detailing the session states and packet structures involved.		AP	16

UNIT IV

TRANSPORT LAYER AND APPLICATION LAYER

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission-Application Layer: DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, Design issues in protocols at different layers, CASE STUDY-Configuration of Router and Switches using Packet Tracer

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define segmentation and reassembly of transport layer.	CO4	RE	2
2.	List the services provided by the transport layer protocol.	CO4	RE	2
3.	Differentiate connection oriented and connectionless services.	CO4	UN	2
4.	Draw the header format of TCP.	CO4	UN	2
5.	Identify the purpose of the three-way handshake in TCP connection establishment.	CO4	UN	2
6.	Define File Transfer Protocol.	CO4	RE	2
7.	Differentiate IMAP and POP.	CO4	UN	2
8.	Distinguish between a User Agent(UA) and a Mail Transfer Agent(MTA).	CO4	UN	2
9.	Infer the role of MIME in e-mail systems.	CO4	UN	2
10.	State the advantage of using Packet Tracer for router and switch configuration.	CO4	RE	2
	PART B			
1.	Describe the connection establishment and connection release in TCP and explain how TCP provides reliability using error control.	CO4	UN	16
2.	Explain in detail about the sliding window flow control of TCP with neat diagrams.	CO4	UN	16
3.	Explain in detail congestion avoidance technquies in TCP.	CO4	UN	16
4.	Explain the role of DNS and its frame format.	CO4	UN	16
5.	Apply the working principles of E-mail systems to illustrate the flow of an electronic message between sender and receiver, explaining the role of relevant protocols.	CO4	AN	16
6.	Analyze the working principles of FTP and HTTP, comparing their connection models, commands, and applications.	CO4	AP	16

UNIT V-NETWORK SECURITY

Network Security:Overview of Network Security:Elements of Network Security , Classification of Network Attacks, Security Methods,Symmetric - Key Cryptography: Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key-Exchange Protocol,Authentication : Hash Function,Secure Hash Algorithm (SHA) ,Digital Signatures , Firewalls and Packet Filtering , Proxy Server

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define network security.	CO5	RE	2
2.	List the core elements of network security.	CO5	RE	2
3.	Differentiate passive attack and active attack.	CO5	UN	2
4.	Identify the role of cryptography in network security.	CO5	UN	2
5.	State the block size and key size used in DES.	CO5	RE	2
6.	List any two advantages of AES over DES.	CO5	RE	2
7.	Infer the role of the Diffie-Hellman key exchange protocol.	CO5	UN	2
8.	Define hash function.	CO5	RE	2
9.	Infer the purpose of Secure Hash Algorithm (SHA).	CO5	UN	2
10.	Differentiate firewall and proxy server.	CO5	UN	2
	PART B			
1.	Classify network security attacks into different categories. Analyze each category with suitable examples and explain their impact on confidentiality, integrity, and availability.	CO5	AP	16
2.	Analyze the Data Encryption Standard (DES) algorithm. Explain its architecture, working principle, and limitations, and justify why it is no longer considered secure.	CO5	AP	16
3.	Examine the Advanced Encryption Standard (AES) algorithm. Analyze its structure, key sizes, rounds, and explain why AES is preferred over DES in modern networks.	CO5	AP	16
4.	Describe the RSA public-key cryptography algorithm. Apply RSA for secure data transmission by explaining key generation, encryption, and decryption processes.	CO5	AN	16
5.	Explain the concept of digital signatures. Apply digital signature techniques to ensure authentication, integrity, and non-repudiation in electronic transactions.	CO5	UN	16
6.	Analyze the working of firewalls and packet filtering mechanisms. Compare them with proxy servers and evaluate their effectiveness in	CO5	AP	16

protecting a network.

24AIPC402

DATA EXPLORATION AND VISUALIZATION

UNIT I

INTRODUCTION TO EXPLORATORY DATA ANALYSIS

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	List any two objectives of EDA.	CO1	RE	2
2.	Define structured data.	CO1	RE	2
3.	What is unstructured data?	CO1	RE	2
4.	Mention any three software tools used for EDA.	CO1	RE	2
5.	What is a dataset?	CO1	RE	2
6.	Define Exploratory Data Analysis (EDA).	CO1	UN	2
7.	Why EDA is important before applying machine learning?	CO1	UN	2
8.	Define visualization in data analysis.	CO1	UN	2
9.	Differentiate between raw data and processed data	CO1	UN	2
10.	How EDA supports in decision making?	CO1	UN	2
	PART B			
1.	(i) Explain the concept and objectives of Exploratory Data Analysis. (ii) Describe the importance of EDA in data science workflows.	CO1	UN	8 8
2.	(i) Explain the relationship between EDA and data preprocessing. (ii) Explain different types of data used in EDA.	CO1	UN	8 8
3.	(i) Describe the steps involved in performing EDA. (ii) Describe common challenges faced during EDA.	CO1	UN	8 8
4.	(i) Describe how EDA improves data quality. (ii) Explain how EDA helps in understanding data structure.	CO1	UN	8 8
5.	(i) Explain EDA tools and their applications. (ii) Discuss the importance of graphical methods in EDA.	CO1	UN	8 8
6.	(i) Discuss the scope of EDA in modern analytics. (ii) Discuss the role of visualization in EDA.	CO1	UN	8 8

UNIT II

UNIVARIATE ANALYSIS

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is a single variable?	CO1	RE	2
2.	Define univariate analysis.	CO1	RE	2
3.	Define standardization.	CO1	RE	2
4.	What is normalization?	CO1	RE	2
5.	Define skewness.	CO1	RE	2
6.	Define the importance of univariate analysis.	CO1	UN	2
7.	Explain why scaling is required.	CO1	UN	2
8.	Explain how skewness affects analysis.	CO1	UN	2
9.	Explain how smoothing reduces noise.	CO1	UN	2
10.	Explain the impact of outliers.	CO1	UN	2
	PART B			
1.	(i) Explain univariate analysis and its significance. (ii) Describe numerical summaries of level and spread.	CO1	UN	8 8
2.	(i) Apply smoothing to time series data. (ii) Demonstrate handling of outliers.	CO1	AP	8 8
3.	(i) Apply dispersion measures to interpret variability. (ii) Apply data transformation techniques.	CO1	AP	8 8
4.	(i) Discuss the importance of dispersion measures. (ii) Explain skewness and kurtosis.	CO1	UN	8 8
5.	(i) Analyze the effectiveness of univariate analysis techniques. (ii) Analyze the impact of outliers on univariate measures.	CO1	AN	8 8

6.	(i) Describe the role of central tendency measures. (ii) Discuss applications of univariate analysis.	CO1	UN	8 8

UNIT III

BIVARIATE ANALYSIS

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define bivariate analysis.	CO1	RE	2
2.	What is meant by a resistant line?	CO1	RE	2
3.	Define data transformation.	CO1	RE	2
4.	What is batch data?	CO1	RE	2
5.	Define categorical variables.	CO1	RE	2
6.	Define trend in a scatterplot.	CO1	UN	2
7.	What is meant by handling several batches?	CO1	UN	2
8.	Define scatter plot.	CO1	UN	2
9.	What is a non-linear relationship?	CO1	UN	2
10.	What is the purpose of bivariate analysis?	CO1	UN	2
	PART B			
1.	(i) Explain bivariate analysis and its importance in exploratory data analysis. (ii) Describe the methods used to study relationships between two variables.	CO1	UN	8 8
2.	(i) Construct a percentage table on your own dataset and interpret it. (ii) Apply cross-tabulation to analyze categorical variables.	CO1	AP	8 8
3.	(i) Analyze relationships between two variables using scatterplots. (ii) Analyze contingency tables to identify associations.	CO1	AN	8 8
4.	(i) Describe the significance of contingency tables. (ii) Explain how batch-wise analysis helps in data comparison.	CO1	UN	8 8
5.	(i) Explain why transformations are applied before analysis. (ii) Describe the role of resistant lines in handling outliers.	CO1	UN	8 8

6.	(i) Explain the advantages of bivariate analysis over univariate analysis.	CO1	UN	8
	(ii) Describe challenges in analyzing two-variable data.			8

UNIT IV

MULTIVARIATE AND TIME SERIES ANALYSIS

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define multivariate analysis.	CO1	RE	2
2.	What is time series analysis (TSA)?	CO1	RE	2
3.	Define time-based indexing.	CO1	RE	2
4.	What is resampling in time series data?	CO1	RE	2
5.	What is seasonality in time series analysis?	CO1	RE	2
6.	Define multivariate dataset.	CO1	UN	2
7.	Define cyclic variation.	CO1	UN	2
8.	What is grouping in data analysis?	CO1	UN	2
9.	List any 4 graphs used in multivariate analysis.	CO1	UN	2
10.	List any 3 real-world applications of time series analysis.	CO1	UN	2
	PART B			
1.	(i) Explain multivariate analysis and the need for introducing a third variable.	CO1	UN	8
	(ii) Explain three-variable contingency tables with suitable examples.			8
2.	(i) Explain the fundamentals of time series analysis.	CO1	UN	8
	(ii) Describe the characteristics of time series data.			8
3.	(i) Explain visualization techniques used in time series analysis.	CO1	UN	8
	(ii) Discuss real-world examples of multivariate and time series analysis.			8
4.	(i) Apply resampling techniques to time-based data using suitable example.	CO1	AP	8
				8

	(ii) Apply resampling techniques to time-based data.			
5.	(i) Examine longitudinal data for trend and pattern identification.	CO1	AN	8
	(ii) Analyze time series data using visualization techniques.			8
6.	(i) Describe grouping techniques in multivariate analysis.	CO1	UN	8
	(ii) Discuss the challenges involved in time series analysis.			8

UNIT V

VISUALIZING USING PLOTLY

Importing Plotly – Bar Chart – Pie Chart – Box Plot – Simple line plots – Simple scatter plots – density plot – Histograms – Heatmap – Treemap – legends – colors – subplots – Slider control – three dimensional plotting - Geographic Data using plotly.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is Plotly?	CO1	RE	2
2.	Mention any two advantages of using Plotly for data visualization.	CO1	RE	2
3.	What is the purpose of a line plot?	CO1	RE	2
4.	What is a box plot?	CO1	UN	2
5.	What is a density plot?	CO1	UN	2
6.	Define treemap.	CO1	UN	2
7.	What is a subplot?	CO1	UN	2
8.	What is geographic data visualization?	CO1	UN	2
9.	What does Plotly Express provide?	CO1	UN	2
10.	What is meant by legends in visualization?	CO1	UN	2
	PART B			
1.	(i) Explain the architecture and features of Plotly for data visualization.	CO1	UN	8
	(ii) Describe different types of plots supported by Plotly with examples.			8
2.	(i) Construct a bar chart using Plotly for categorical data.	CO1	AP	8
	(ii) Construct a line plot to visualize time-series data.			8
3.	(i) Describe the role of Plotly in modern data analytics.	CO1	UN	8
	(ii) Describe geographic data visualization using Plotly.			8
4.	(i) Construct a histogram for numerical data analysis.	CO1	AP	8
	(ii) Apply density plots for smooth distribution analysis.			8

5.	(i) Analyze the effectiveness of different Plotly charts for data storytelling. (ii) Analyze how box plots help in understanding data variability.	CO1	AN	8 8
6.	(i) Analyze the effectiveness of slider controls in visualization. (ii) Examine the importance of 3D plots in complex datasets.	CO1	AN	8 8

24ESBS401-ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

UNIT I-ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Environment**:** Definition, scope and importance of the environment.
Ecosystem**:** Definition, structure and function of an ecosystem (Forest ecosystem and River ecosystem) – producers, consumers and decomposers - Ecological succession.
Biodiversity**:** Introduction, Definition and Types – values of biodiversity – threats to biodiversity-habitat loss and poaching of wildlife, case study of man-wildlife conflicts – conservation of biodiversity..

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is an ecosystem and what are the components of ecosystem?	CO1	RE	2
2.	What are biotic and abiotic components of an ecosystem?	CO1	RE	2
3.	What do you mean natural resources? Give examples.	CO1	RE	2
4.	What are food chains and food webs and give their significance?	CO1	RE	2
5.	Define Ecological succession.	CO1	RE	2
6.	Differentiate between endangered and endemic species.	CO1	UN	2
7.	Define primary succession and secondary succession	CO1	RE	2
8.	Define key stone species with a suitable example.	CO1	RE	2
9.	List out the effect of habitat loss on biodiversity.	CO1	RE	2
10.	What are the major causes of man-wildlife conflict?	CO1	RE	2
	PART B			
1.	Define ecosystem. What are the classification of ecosystem and explain in detail?	CO1	AP	16
2.	Discuss in detail about the threats faced by Indian biodiversity.	CO1	AP	16
3.	Name and briefly describe two how spots of biodiversity that extent in India.	CO1	AN	16
4.	Write about In-situ and Ex-situ conservation of	CO1	AP	16

	biodiversity.			
5.	Explain in detail about the endangered and endemic species of India.	CO1	AN	16
6.	Define Ecological succession. Classify the types of succession and explain in detail.	CO1	AP	16

UNIT II-ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT

Pollution - definition –causes, effects and control measures of (a) air pollution (b) water pollution- Solid and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS)

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Differentiate between primary and secondary air pollutants.	CO2	UN	2
2.	Define photochemical smog.	CO2	RE	2
3.	What are point and non -point sources of water pollution?	CO2	RE	2
4.	Define e-waste management.	CO2	RE	2
5.	Name any four environmental protection acts in India.	CO2	RE	2
6.	Define hazardous waste management.	CO2	RE	2
7.	What are the effects of noise pollution?	CO2	RE	2
8.	Write any two causes and sources of soil pollution.	CO2	UN	2
9.	List out sources of toxic pollutants in water?	CO2	RE	2
10.	Define OHASMS.	CO2	RE	2
	PART B			
1.	Define air pollution .What are the sources of air pollution? Explain the approach to control air pollution.	CO2	AP	16
2.	Demonstrate with a flow sheet and explain the steps involved in Solid waste management.	CO2	AN	16
3.	What is OHASMS? Explain it with any one case study	CO2	AP	16

4.	Write a detailed note on solid, hazardous, and e-waste management.	CO2	AP	16
5.	Explain the causes, effects and control measures of water pollution.	CO2	AP	16
6.	Give a comparative account of urban and industrial wastes in terms of their sources, characteristics and management and disposal methods.	CO2	AN	16

UNIT III- NATURAL RESOURCES

Forest resources-use and over-exploitation, deforestation, Water resources- use and over utilization of surface and ground water, drought, Dams benefits and problems, Food resources-changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, role of an individual in conservation of natural resources

Q.No	Question	CO	BTL	Marks
	PART A			
1.	Define sustainable forestry	CO3	RE	2
2.	Mention any two causes of over-exploitation of forests	CO3	RE	2
3.	What are the effects of dams on tribal communities?	CO3	UN	2
4.	What is water logging?	CO3	RE	2
5.	Define overgrazing.	CO3	RE	2
6.	What is meant by soil erosion?	CO3	RE	2
7.	What is desertification?	CO3	RE	2
8.	Write any two adverse effects caused by overgrazing.	CO3	UN	2
9.	What are the types of agriculture?	CO3	RE	2
10.	What are the preventive measures for protecting natural resources?	CO3	UN	2
	PART B			
1.	Explain in detail the role of an individual in the conservation of natural resources.	CO3	AP	16
2.	Describe the major causes of deforestation. Discuss its consequences and suggest measures to overcome it.	CO3	AN	16

3.	Write a brief note on the environmental impacts of modern agriculture with reference to: (i) Fertilizers (ii) Pesticides	CO3	AP	16
4.	Elaborate the changes caused by modern agriculture and overgrazing.	CO3	AN	16
5.	Explain in detail about the over-utilization of surface water and groundwater.	CO3	AP	16
6.	Discuss the various factors influencing soil degradation.	CO3	AN	16

UNIT IV

SUSTAINABILITY AND MANAGEMENT

Development, GDP, Sustainability- concept, needs and challenges-millennium development - indicators and intervention areas -Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is GDP?	CO4	RE	2
2.	List out any four millennium development goals.	CO4	UN	2
3.	Define carbon credit.	CO4	RE	2
4.	What are the sources of carbon foot print?	CO4	RE	2
5.	Define environmental management.	CO4	RE	2
6.	Mention any five important needs of sustainability.	CO4	UN	2
7.	Enlist the advantages of carbon credits.	CO4	RE	2
8.	Mention some effects of climate change.	CO4	UN	2
9.	Write any 4 millennium development goals.	CO4	RE	2
10.	Define Sustainability.	CO4	RE	2
	PART B			
1.	Write brief notes on (i) Millennium Development Goals (ii) Sustainability protocols.	CO4	AP	16
2.	What is environmental management? Explain the various	CO4	AP	16

steps of environmental management.

3.	Analyse the of concept, goal and aim of sustainable development.	CO4	AN	16
4.	What are the causes, effects and possible solutions of climate change? What is carbon credit? Explain the types and merits.	CO4	AP	16
5.	Explain the sources, causes and remedy measures of carbon foot print.	CO4	AN	16
6.	Analyze the sustainable development indicators.	CO4	AN	16

UNIT V

SUSTAINABILITY PRACTICES

Sustainable targets and goals (STG), Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Sustainable transports, Sustainable urbanization- Socio-economical and technological change.

Q.No	Question	CO	BTL	Marks
	PART A			
1.	What is zero waste and R concept?	CO5	RE	2
2.	Define circular economy.	CO5	RE	2
3.	What are the key elements of ISO14000?	CO5	RE	2
4.	Mention the objectives of EIA.	CO5	UN	2
5.	What is green engineering?	CO5	RE	2
6.	What is meant by energy cycles?	CO5	RE	2
7.	What is sustainable urbanization?	CO5	RE	2
8.	Define carbon sequestration.	CO5	RE	2
9.	How do you calculate energy efficiency?	CO5	UN	2
10.	What are the harmful effects of carbon emission?	CO5	RE	2
	PART B			
1.	Explain the various steps to achieve zero waste? Mention advantages and disadvantages of zero waste.	CO5	AP	16

2.	Determine the concept and advantages of R concept.	CO5	AN	16
3.	What are green materials? Explain important green building materials. (8) What is sustainable transport? Discuss the key elements of sustainable transport.(8)	CO5	AP	16
4.	What is sustainable urbanization? Explain the rules to develop sustainable urban.	CO5	AN	16
5.	Write notes on socio-economical change on sustainable urbanization.	CO5	AP	16
6.	Explain methods of achieving energy efficiency.	CO5	AP	16

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