MITE
Invent Solutions

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

Model Question Paper

First Semester MCA Degree Examination

Problem Solving and Programming in Python

Time: 3 Hours **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

		Module -1	M	L	C
Q1	a.	Construct a Python program to implement a temperature converter that converts Celsius to Fahrenheit and Kelvin based on user input. Illustrate how the program is executed through the Python interpreter with proper variable handling and arithmetic operations.	10	L3	CO1
	b.	Develop a Python program that accepts a number from the user and determines whether it is a palindrome number. Implement this using both a `while` loop and a recursive approach, and compare them in terms of execution efficiency.	10	L3	CO1
		OR			
Q2	a.	Develop a Python function that computes the factorial of a number, power of a number, and GCD of two numbers using default parameters. Allow flexible argument passing and explain how default parameters enhance code reusability.	10	L3	CO1
	b.	Construct a Python program using nested if-elif-else statements to classify a student's grade based on marks: Distinction (>=80), First Class (>=60), Second Class (>=50), Pass (>=40), and Fail (<40). Illustrate the decision-making logic in your implementation.	10	L3	CO1
		Module- 2			
Q3	a.	Model a Python function that takes a string as input and performs the following operations: converts it to uppercase, removes vowels, and counts consonants. Illustrate as to how you will use string methods and character iteration in your solution.	10	L3	CO2
	b.	Develop a Python function that accepts a list of integers, filters out negative numbers, and returns the list in ascending order. Utilize list comprehensions and explain the advantages of using comprehensions over traditional loops.	10	L3	CO2
		OR			
Q4	a.	Develop a Python program that defines a base class `Vehicle` with methods `start()` and `stop()`, and derived classes `Car` and `Motorcycle` that override these methods with specific implementations. How does inheritance promote code reusability and polymorphism.	10	L3	CO2
	b.	Implement a Python program that formats student information (roll number, name, CGPA, branch) using both the `.format()` method and f-strings. Compare the readability and advantages of each approach.	10	L3	CO2
		Module – 3			

Q5	a.	Model a Pandas DataFrame containing student information (Roll_No, Name, Branch, CGPA, Semester). Write functions to: add a new column for scholarship eligibility (CGPA >= 8.5), filter students by branch, and sort by CGPA in descending order. Explain the key Pandas operations used in this case.	10	L3	CO3
	b.	Build a NumPy array of shape (4, 4) filled with values from a normal distribution. Explain how to extract specific rows, columns, and sub-arrays using slicing and indexing. Demonstrate element-wise operations.	10	L3	CO3
OR					
Q6	a.	Implement a Python code to handle missing data in a Pandas DataFrame using multiple strategies: dropping, filling with mean/median, and forward/backward filling. Compare the impact of each approach on data analysis.	10	L3	CO3
	b.	Develop a Python program using NumPy to perform statistical operations (mean, median, standard deviation, variance) on two arrays and compare their statistical properties. Illustrate the use of universal functions for efficient computation.	10	L3	CO3
Module – 4					
Q7	a.	Model a Python function that performs join operations on two Pandas DataFrames based on a common column (e.g., student ID) using inner, outer, left, and right joins. Explain the use cases and differences between each join type in data integration scenarios.	10	L3	CO4
	b.	Develop a Python script that reads a JSON file containing product data, converts it to a DataFrame, removes duplicate entries, calculates statistics (total, average price), and exports results to a CSV file. Illustrate efficient file handling and data processing.	10	L3	CO4
OR					
Q8	a.	Develop a Python program that reads data from an Excel file into a Pandas DataFrame, filters rows based on multiple conditions, performs groupby aggregations, and writes the summarized results to a new Excel sheet. Explain how Pandas handles spreadsheet data.	10	L3	CO4
	b.	Model a Python script that applies lambda and map functions to transform a DataFrame column (e.g., converting all names to title case and extracting year from date strings). Show how functional programming enables concise data transformations.	10	L3	CO4
Module – 5					
Q9	a.	Implement a Python function that takes a dataset with multiple variables and creates a histogram with customized bins, colors, and labels using Matplotlib. Add statistical overlays (mean and median lines) and explain the importance of histograms in exploratory data analysis.	10	L3	CO5
	b.	Develop a Python script that uses Seaborn to create a heatmap representing the correlation matrix of a numerical dataset. Customize the heatmap with a diverging color palette, annotations, and a descriptive title. Illustrate how correlation heatmaps help identify variable relationships.	10	L3	CO5
OR					
Q10	a.	Develop a Python script that generates multiple subplots using Matplotlib: a line plot for trends, a bar plot for comparisons, and a pie chart for distributions. Demonstrate how subplot layouts can present multiple perspectives of data simultaneously.	10	L3	CO5
	b.	Implement a Python function that generates a bar plot using Matplotlib to visualize sales data across different product categories. Customize the plot with: - Different colors for each category - Value labels on top of each bar - Grid lines for better readability	10	L3	CO5

		- Proper title, axis labels, and legend			

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