BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : V**
BRANCH: AIML **SESSION : MO/2025**

SUBJECT: AI313 CLASSICAL OPTIMIZATION TECHNIQUES

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Optimize the following Code Segment	[2]	1	3

```
for(i=0; i<num; i++)
 for (j=0; j<num-i; j++)
  nums[i][j+i]= -num[i][j+1];
```

Q.1(b)	Optimize the following code segment with explanation/justification	[3]	1	3

```
if((a<2 && (b<3)) x=y;
elseif (( a<2) && (b>=3)) x=z;
elseif((a>=2)) && (b<3)) x=-y;
else if ((a>=2) && (b>=3)) x=-z;
```

Q.2(a)	Given a BST and a Key, Propose an Optimal Solution/Algorithm/Procedure to find the element in BST which is closet to the given key.	[2]	2	3
Q.2(b)	Design a Cost/Recursive function to find the Longest Common Subsequence between two input strings. Explain with an example.	[3]	2	3
Q.3(a)	Create a Huffman Tree and find the Optimal Code for the alphabets whose frequencies are a=21, b=6, c=4, d=2, e=25, f=1, g=2, h=7, i=18, j=8	[2]	3	2
Q.3(b)	A Protein Farm uses at least 800 lb of special feed daily. The special feed is a mixture of Corn and soybean with the following compositions.	[3]	3	2

Feedstuff	Protein	Fiber	Cost($/lb)
Corn	0.09	0.02	0.30
Soybean	0.60	0.06	0.90

The dietary requirements of the special feed are at least 30% protein and at most 5% fiber. The objective is to minimize the total cost of the feed mixture. Prepare Mathematical Formulation for this Problem.

Q.4(a)	Solve Maximize z= $5x_1+4x_2$ subject to $6x_1+4x_2 <= 24$ $x_1+2x_2 <= 6$ $-x_1+ x_2 <=1$ $X_2 <=2$ and $x_1, x_2 >=0$	[2]	4	2
Q.4(b)	ABC Bank is in the process of devising a loan policy that involves a maximum of 12 million dollars. The following table provides the pertinent data about the available loans.	[3]	4	3

Type of loan	Interest Rate	Bad-debt ratio
Personal	0.140	0.10
Car	0.130	0.07
Home	0.120	0.03
Farm	0.125	0.05
Commercial	0.100	0.02

Bad debts are unrecoverable and produce no interest revenue.
Competition with other financial institutions dictates the allocation of at least 40% of the funds to farm and commercial loans. To assist the housing industry in the region, home loans must equal at least 50% of the personal, car and home loans. The bank limits the overall ratio of bad debts on all loans to at most 4%. The Objective of the Bank is to maximize net return. Prepare a mathematical formulation of this problem.

PTO

Q.5(a) Nikhil is an aspiring sportsman at BIT University. He realizes that "all study and no play make Nikhil a dull boy". Nikhil wants to apportion his available time of about 10 hours a day between study and play. He estimates that playing is twice as much fun as studying. He also wants to study at least as much as he plays. However, Nikhil realizes that if he is going to get all his homework assignments done, he can not play more than 4 hours a day. How should Nikhil allocate his time to maximize his pleasure from both study and play? [2] 5 3

Q.5(b) Birla Garments manufacture Men's shirt and Women's Saree for Pantaloon stores. Pantaloon will accept all the production supplied by Birla Garments. The prediction process includes cutting, sewing and packaging. Birla Garment employs 25 workers in the cutting department, 35 in the sewing department and 5 in the packaging department . The factory works one 8-hour shift, 5 days a week. The following table gives the time requirement and profits per unit for the garments. [3] 5 3

Garment	Cutting	Sewing	Packaging	Profit/ Unit
Shirts	20	70	12	8
Saree	60	60	4	12

Determine the optimal weekly production schedule for Birla Garment.

:::::18/09/2025 :::::M