

Sub : **CE 363** (Elements of Civil Engineering Structures)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

Assume any reasonable value of missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Classify standard steel roll shapes. (6)
 (b) Write short note on: basic type of welding joints. (6)
 (c) Compute the tensile service load capacity for the bearing-type connection of two members in Figure 01 if the bolt threads are excluded from the shear plane. Use AISC Specification-LRFD Method with 7/8 in. diameter A325 ($F_y = 90$ ksi, $F_u = 120$ ksi) bolts in standard holes and A572 Grade 50 steel plates. The service live load is three times the service dead load. (23)
2. (a) Check if the number of A325 ($F_y = 90$ ksi, $F_u = 120$ ksi) bolts provided is adequate for the system shown in Figure 02. Consider development of full strength of the plates. The steel plates are of A572 Grade 65 with threads excluded from the shear planes. Use AISC-LRFD Method. (18)
 (b) Describe four typical bolted connections. (12)
 (c) Write down the classification of welding. (5)
3. (a) Describe the behavior of a prismatic member under compression. (6)
 (b) Write down the assumptions of ideal column. (6)
 (c) Check the adequacy of the W10×45 (A992 steel) section for the column shown in Figure 03. The column carries an axial compression load of 65 kips dead load and 145 kips live load in a braced structure. The member is assumed pinned at top and bottom and in addition has weak direction support at mid-height. Use AISC Allowable Strength Design Method. Given that for W10×45, the radius of gyration about x and y axes are 4.32" and 2.01", respectively. (23)
4. (a) What are the most common stages to be checked for stresses and behavior, explain. (5)
 (b) A prestressed-concrete beam as shown in Figure 04 has a simply supported span of 30 ft and is loaded by a uniform load of 3.5 kip/ft including its own weight. The prestressing tendon is located as shown and produces an effective prestress of 300 kip. Compute maximum fiber stresses at top and bottom fibers in the concrete section. (15)

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(c) Make a preliminary design for section of a prestressed-concrete beam to resist a total moment of 350 kip-ft. The overall depth of the section is given as 30 in. The effective prestress for steel is 125,000 psi and allowable stress for concrete under working load is 1600 psi. Also draw the cross-section of the beam.

(15)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Write short note on: serviceability, strength, safety of structure. (5)
- (b) Write short note on: sources of uncertainty in analysis, design and construction of RCC structures. (7)
- (c) Design a 12-ft simply supported slab to carry a uniform dead load (excluding self-weight) of 120 psf and a uniform live load of 100 psf. Width of the slab is 8 ft. Given, $f'_c = 3000$ psi, $f_y = 60$ ksi. (23)
6. (a) What type of floor system is used where long clear spans are required for roofs? (5)
- (b) Discuss the behavior of reinforced concrete beam under increasing load. (15)
- (c) An 8-ft-span cantilever beam has a rectangular section and reinforcement as shown in Figure 05. The beam carries a dead load, including its own weight, of 1.5 k/ft and a live load of 0.9 k/ft. Given, $f'_c = 4000$ psi, $f_y = 60$ ksi, check if the beam is safe to carry the above loads. (15)
7. (a) Elaborate the statement: bending is almost always present in columns. (5)
- (b) Write short note: (15)
- (i) strength interaction diagram of column
- (ii) balanced failure mode of RCC column
- (iii) value of Φ (phi) used for RCC column design
- (c) Design a square tied column to support an axial dead load of 400 kip and a live load of 232 kip. Given $f'_c = 5000$ psi, $f_y = 60$ ksi and a steel ratio of about 5%. Design the necessary ties. (15)
8. (a) Describe the reinforcement detailing of beam and column for IMRF structure. (10)
- (b) Write down the advantages of reinforced concrete. (5)
- (c) Design a reinforced concrete footing to support a 20-in. wide concrete wall carrying a dead load of 26 k/ft, including the weight of the wall, and a live load of 20 k/ft. The bottom of the footing is 6 ft below final grade. Use normal-weight concrete with $f'_c = 4000$ psi, $f_y = 60$ ksi, and an allowable soil pressure of 5 ksf. (20)



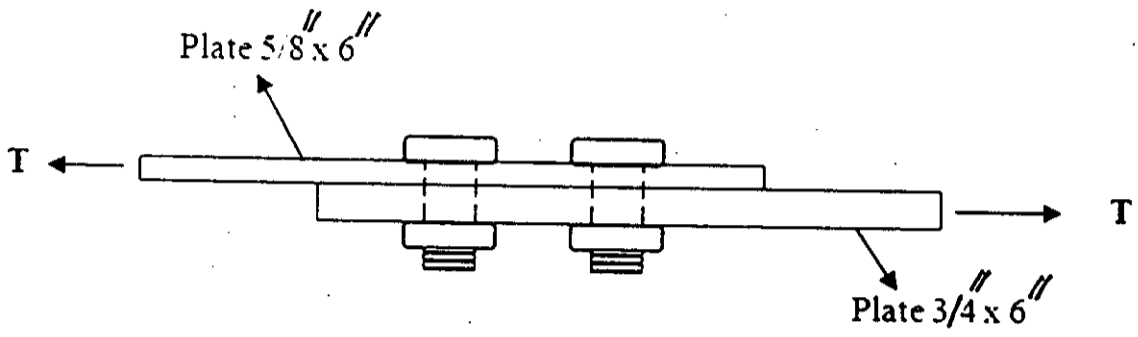
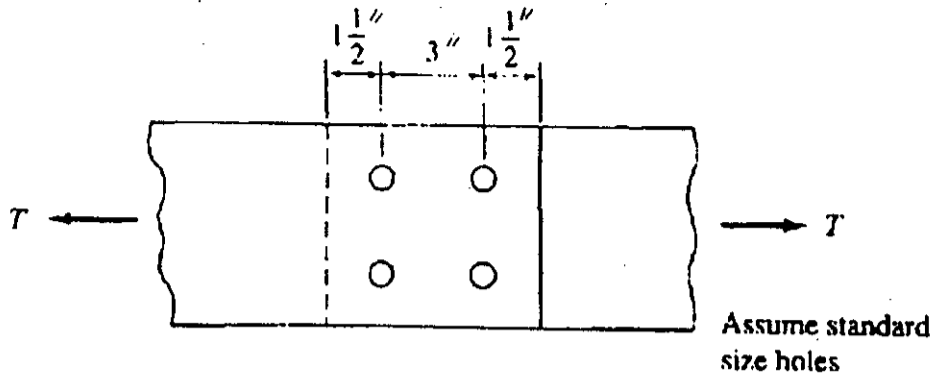


Figure 01

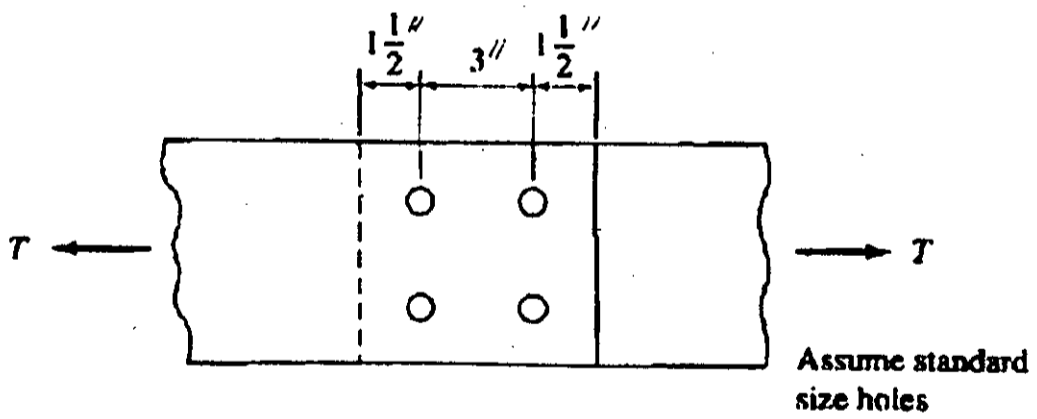
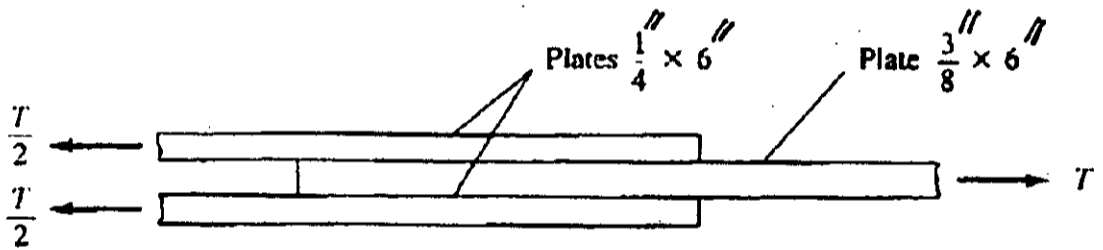


Figure 02

D

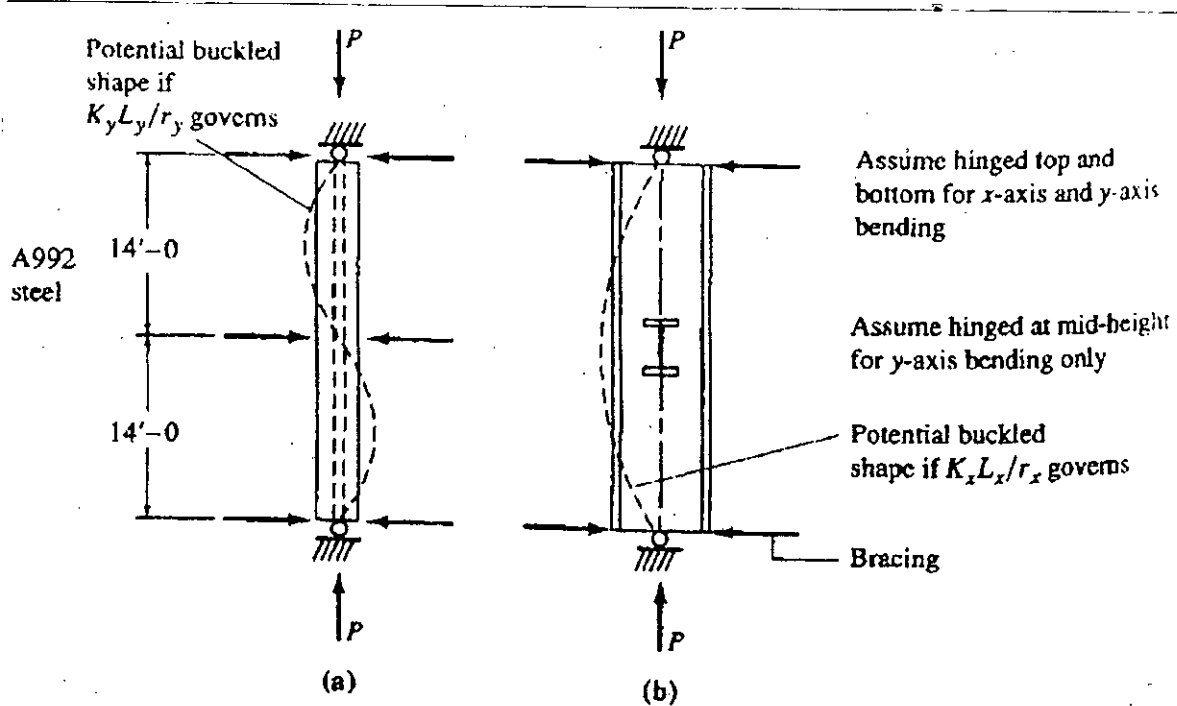


Figure 03

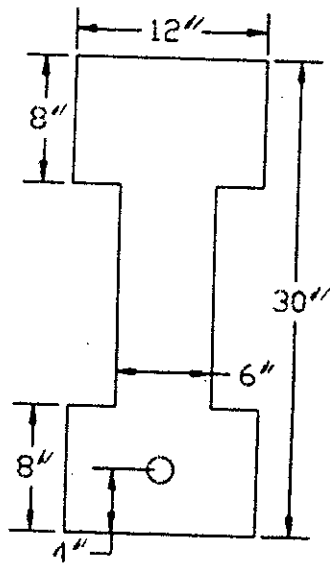


Figure 04

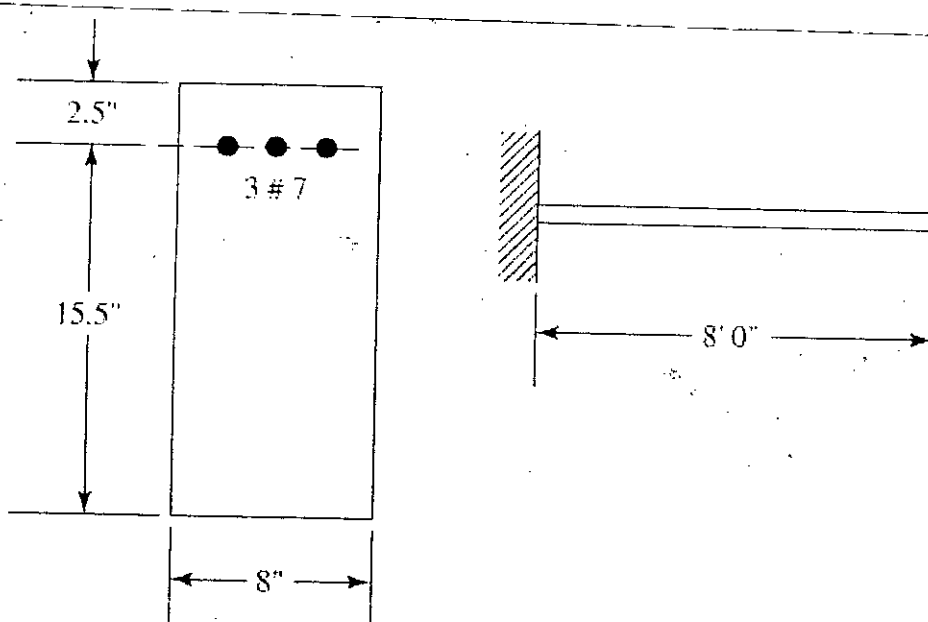


Figure 05

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Discuss the major differences between the approaches of "Central Place Theory" and "Growth Pole Theory." Which one do you think is more appropriate in the context of Bangladesh? Justify your answer with examples. **(10+5=15)**
 - (b) "Cristaller believed that hierarchy of central places could be organized according to three principles." – discuss those three principles with necessary illustrations. **(12)**
 - (c) Once demand cone is formed in the theory of Lösch, how do you think the features of the conic can help in understanding the market? Discuss with necessary illustrations. **(8)**

2. (a) Differentiate between "Trickling down effort" and "Backwash effort" with examples. **(6)**
 - (b) How does the "Growth Pole Theory" play an important role in regional planning? Discuss briefly with examples. **(10)**
 - (c) Discuss the types of agglomeration economies. **(9)**
 - (d) Briefly discuss the limitations of "Central Place Theory." **(10)**

3. (a) What do you understand by "Agropolitan Growth"? How can you promote "Agropolitan Growth" through some development actions in Bangladesh? **(5+10=15)**
 - (b) Briefly discuss the evolution of industrial policies of Bangladesh. Describe the key focuses of the policies. **(10+10=20)**

4. (a) How do you think macro-policy options can help to develop the stressed region of Bangladesh? Discuss briefly. **(15)**
 - (b) How does the theory of "Profit Maximization" address the limitations of Weber's and Lösch's theory of industrial location? Discuss with necessary illustrations. **(20)**

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define and classify region mention some ways of regionalization. (10)
(b) 'Regional growth depends on different factors' – Name them. (5)
(c) Explain the Weighted Index Number Method. (20)
6. (a) What will be the impact of injection of X million taka in Rangpur Division? Discuss three major leakages in this regard. (15)
(b) "The regional economy can be subdivided into-basic and non basic activities' – Discuss the theory associated with the statement. (20)
7. (a) Why do you need to study the "migration" aspect in terms of understanding regional characteristics? Mention some theories of migration. (10)
(b) State the macro-economic model for long-run regional growth. (5)
(c) Describe Marris Todare model in detail. (20)
8. (a) Write short notes on the following: (3×5=15)
(i) Input-output table
(ii) Location Quotients (LQ) method
(iii) Export base theory.
(b) Discuss the components to analyze industrial structure. (20)
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SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are the different geographical/ administrative or revenue unit of rural areas in Bangladesh? (5)
(b) Why rural planning is necessary in a country like Bangladesh? (10)
(c) What is 'Comilla Model'? What are the major components of this model? (20)
2. (a) What is Integrated Rural Development (IRD)? Discuss about production-oriented and target group-oriented IRD model. (15)
(b) 'Rural development means development of rural livelihood in a sustainable way'- Explain. By using asset pentagon, show the difference asset status based on different poverty levels of rural households. (8)
(c) Show the Sustainable rural livelihood framework. Describe different rural livelihood strategies. (12)
3. (a) Explain rural-urban continuum. (5)
(b) 'In some cases, rural-urban linkage can increase inequality and vulnerability' - How? (10)
(c) Differentiate between PRA and RRA. 'Social map is different from other regular maps in significant ways' - Explain. (20)
4. (a) According to you, what are the major challenge of rural development in Bangladesh at the moment? Name them. (5)
(b) Write short notes on the following: (3×10)=30
(i) Compact Township
(ii) Land-Fragmentation and Subdivision.
(iii) BRDB

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) "In Bangladesh, it has been observed that some of the rural markets are performing better than some of the rural markets which are upgraded to growth center" -Explain this stalemate in the light of theories and practices of growth center selection (20)
- (b) "Infrastructure services in Bangladesh are largely provided by the public section". Do you agree with this statement? Justify your answer. (15)
6. (a) The social development scene in Bangladesh is characterized by a strong presence of Non-Government Organizations (NGOs). Discuss how NGOs contribute to reduce poverty in rural areas of Bangladesh from different poverty approach perspectives. (23)
- (b) "In different concepts of direct monetary poverty approach, determination of poverty line is one of the major challenges." - Explain. (12)
7. (a) Compare the strategies and targets related to rural governance in different Five Year plans of Bangladesh. (18)
- (b) Upgradation of rural markets into growth centers through provision of different infrastructure contribute to rural as well as national development from different perspectives. Discuss the importance of infrastructure provision in rural markets of Bangladesh. (17)
- 8 (a) Rural Infrastructure Improvement Project I (RIIP I) was implemented in rural areas of Khulna and Barisal division in Bangladesh in between July 2003 to July 2010. Discuss how different measures implemented in this project reflect the strategies of 6th Five Year Plan. (25)
- (b) Identify the poverty concept in which "individual assessment of one's material status/poverty" is considered for poverty measurement. Discuss the shortcomings of this poverty concept. (10)
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Sub : **PLAN 393** (Operations Research and System Analysis)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) A newly constructed toll bridge is operated with a single toll collector. During the peak hours, buses arrive at a rate of 24 buses per hour. The average of buses that can be served by the toll collector is 30 per hour. Calculate the following. (3×5=15)
- (i) The probability that the toll collector is idle.
 - (ii) The average number of buses in the queue.
 - (iii) The average time a bus spends in the queue.
- (b) Solve the following game by graphic method. The pay offs are for player 'A'. Player 'A' has here strategies and player 'B' has five strategies. (20)

		Player B				
		1	2	3	4	5
Player A	1	-5	5	0	-1	8
	2	8	-4	-1	6	-5
	3	-7	-5	-2	-2	-6

2. (a) Is the matrix in Table 1 on optional solution of the transportation problem (Table 2)? If not, modify it to obtain the optional solution. Here, Table 2 is the cost matrix in '000 BDT. (35)

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="4">Table 1</th> </tr> <tr> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%; text-align: center;">50</td> <td style="width: 25%; text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">55</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">35</td> <td></td> <td style="text-align: center;">25</td> </tr> </table>	Table 1						50	20	55				30	35		25	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="4">Table 2</th> <th style="text-align: left;">Supply (kg)</th> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">1</td> <td style="text-align: center;">9</td> <td style="text-align: center;">3</td> <td style="text-align: center;">70</td> </tr> <tr> <td style="text-align: center;">11</td> <td style="text-align: center;">5</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> <td style="text-align: center;">55</td> </tr> <tr> <td style="text-align: center;">10</td> <td style="text-align: center;">12</td> <td style="text-align: center;">4</td> <td style="text-align: center;">7</td> <td style="text-align: center;">90</td> </tr> <tr> <td style="text-align: center;">85</td> <td style="text-align: center;">35</td> <td style="text-align: center;">50</td> <td style="text-align: center;">45</td> <td></td> </tr> </table>	Table 2				Supply (kg)	6	1	9	3	70	11	5	2	8	55	10	12	4	7	90	85	35	50	45	
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11	5	2	8	55																																						
10	12	4	7	90																																						
85	35	50	45																																							
Demand (kg)→																																										

3. 'X' and 'Y' are in the process of ranting a house. Three houses A, B, and C are available. They have agreed on two criteria for the selection of the house: proximity to work (w) and proximity to kid's school (s), and have developed the following comparison matrices. Develop the decision tree, rank the three houses in order of priority, and compute the consistency ratio for each matrix. (10+15+10=35)

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Contd ... Q. No. 3

$$A = \begin{matrix} & x & y \\ \begin{matrix} x \\ y \end{matrix} & \begin{pmatrix} 1 & 2 \\ 1/2 & 1 \end{pmatrix} \end{matrix}$$

$$A_x = \begin{matrix} & s & w \\ \begin{matrix} s \\ w \end{matrix} & \begin{pmatrix} 1 & 1/3 \\ 3 & 1 \end{pmatrix} \end{matrix} \quad A_y = \begin{matrix} & s & w \\ \begin{matrix} s \\ w \end{matrix} & \begin{pmatrix} 1 & 4 \\ 1/4 & 1 \end{pmatrix} \end{matrix}$$

$$A_{xs} = \begin{matrix} & A & B & C \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{pmatrix} 1 & 2 & 3 \\ 1/2 & 1 & 2 \\ 1/3 & 1/2 & 1 \end{pmatrix} \end{matrix} \quad A_{xw} = \begin{matrix} & A & B & C \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{pmatrix} 1 & 2 & 1/2 \\ 1/2 & 1 & 1/3 \\ 2 & 3 & 1 \end{pmatrix} \end{matrix}$$

$$A_{ys} = \begin{matrix} & A & B & C \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{pmatrix} 1 & 4 & 2 \\ 1/4 & 1 & 3 \\ 1/2 & 1/3 & 1 \end{pmatrix} \end{matrix} \quad A_{yw} = \begin{matrix} & A & B & C \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{pmatrix} 1 & 1/2 & 4 \\ 1/2 & 1 & 3 \\ 1/4 & 1/3 & 1 \end{pmatrix} \end{matrix}$$

4. (a) Dhaka Mass Transit Company Ltd (DMTCL) is planning to launch a campaign for the upcoming Mass Rapid Transit (MRT) project. The research department is convinced that the campaign will be a great success and wants to introduce it immediately without advertising. The marketing department wants to kick off an intensive advertising program. The cost of advertising will be Tk. 100,000, and if successful will produce Tk. 950,000 revenue. If the advertising doesn't work (there is a 30% chance it won't be), the revenue is estimated at only Tk. 200,000. If no advertising is used, the revenue is estimated at Tk. 400,000 with a probability of 0.8 if users are receptive and Tk. 200,000 with a probability of 0.2 if they are not. Construct the decision tree. What course of action should DMTCL follow in launching the campaign? (10+10=20)
- (b) A project manager wishes to put four repairmen to four different jobs. The repairmen have somewhat different kinds of skill and they exhibit different levels of efficiency from one job to another. The manager has estimated the number of man hours that would be required for each job-man combination. This is given in the matrix in Table 3. Find the optimum assignment that will result in minimum manhours needed. (15)

Table 3

Man	Job	A	B	C	D
1		5	3	2	8
2		7	9	2	6
3		6	4	5	7
4		5	7	7	8

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. Ralph Edmund Loves steaks and potatoes. Therefore, he has decided to go on a steady diet of only these two foods (plus some liquids and vitamin supplements) for all his meals. Ralph realizes that this isn't the healthiest diet, so he wants to make sure that he eats the right quantities of the two foods to satisfy some key nutritional requirements. He has obtained the following nutritional and cost information (Table 4).

Table 4

Ingredient	Grams of Ingredient per serving		Daily Requirement (Grams)
	Steak	Potatoes	
Carbohydrates	5	15	≥ 50
Protein	20	5	≥ 40
Fat	15	2	≤ 60
Cost per serving	\$4	\$2	

Ralph wishes to determine the number of daily servings (may be fractional) of steak and potatoes that will meet these requirements at a minimum cost.

- (a) Formulate a linear programming model for this problem. **(15)**
- (b) Use the graphical method to solve this model. **(20)**
6. (a) Solve the following problem using tabular simplex method. **(20)**

Maximize $Z = 3x_1 + 2x_2$

Subject to

$x_1 \leq 4$

$x_1 + 3x_2 \leq 15$

$2x_1 + x_2 \leq 10$

and $x_1 \geq 0, x_2 \geq 0$

- (b) Construct the dual form of the following problem. **(15)**

Minimize $z = x_1 + 2x_2$

Subject to

$-2x_1 + x_2 \geq 1$

$x_1 - 2x_2 \geq 1$

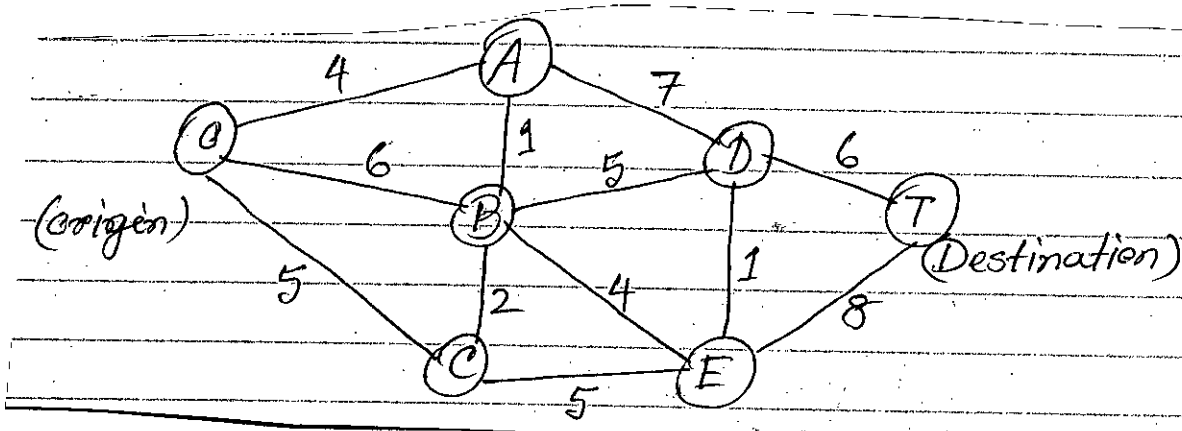
and

$x_1 \geq 0, x_2 \geq 0.$

7. (a) Use an algorithm to find the shortest path of the following network where the numbers represent actual distances between the corresponding nodes. **(15)**

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Contd ... Q. No. 7(a)



(b) Solve the following problem using revised simplex method (matrix form).

(20)

Maximize $Z = 10x_1 + 20x_2$

Subject to

$-x_1 + 2x_2 \leq 15$

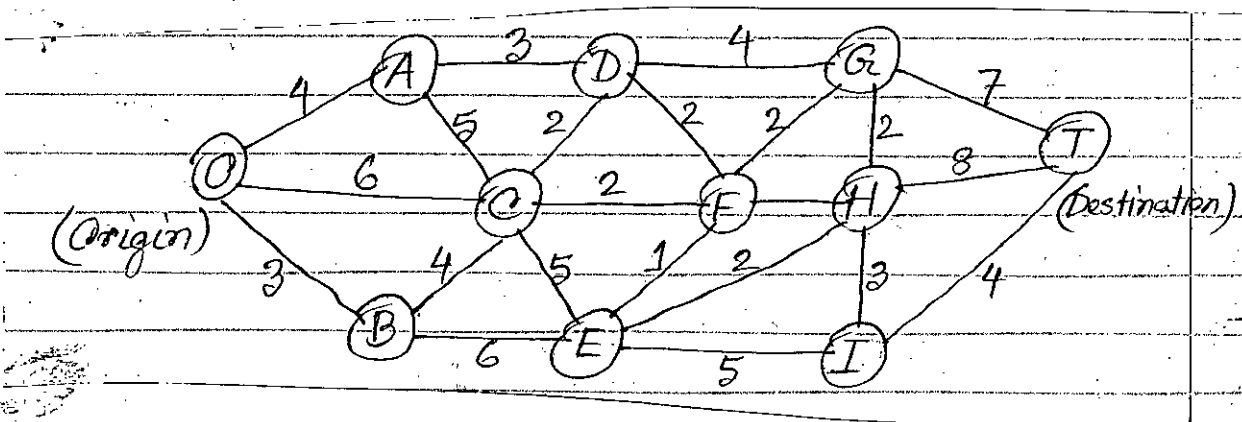
$x_1 + x_2 \leq 12$

$5x_1 + 3x_2 \leq 45$

and $x_1 \geq 0, x_2 \geq 0$

8. (a) Use as algorithm to find the minimum spanning tree of the following network.

(20)



(b) Consider the following problem.

Maximize $Z = 8x_1 + 4x_2 + 6x_3 + 3x_4 + 9x_5$

Subject to

$x_1 + 2x_2 + 3x_3 + 3x_4 \leq 180$ (resource 1)

$4x_1 + 3x_2 + 2x_3 + x_4 + x_5 \leq 270$ (resource 2)

$x_1 + 3x_2 + x_4 + 3x_5 \leq 180$ (resource 3)

and $x_j \geq 0 \quad j = 1, \dots, 5$

= 5 =

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Contd ... Q. No. 8(b)

You are given the facts that the basic variables in the optimal solution are x_3 , x_2 and x_5 and that

$$\begin{bmatrix} 3 & 1 & 0 \\ 2 & 4 & 1 \\ 0 & 1 & 3 \end{bmatrix}^{-1} = \frac{1}{27} \begin{bmatrix} 11 & -3 & 1 \\ -6 & 9 & -3 \\ 2 & -3 & 10 \end{bmatrix}$$

Use the given information to identify the optimal solution.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) "Transportation planning is not only transportation modeling, but much more." Explain this statement. (10)

(b) Differentiate between the concern of problem solving and transportation planning with relevant example(s). (8)

(c) A self contained town consists of four residential areas A, B, C, D and two industrial estates X and Y. Trip generation equations show that for the design year in question, the trips from home to work generated by each residential area per 24 hour day are as follows: (17)

A	500
B	1125
C	875
D	1600

There are 3700 jobs in industrial estate X and 4500 jobs in industrial estate Y. It is known that the attraction between zones is inversely proportional to the square of the journey times between zones. The journey time in minutes from home to work are:

Zones	X	Y
A	15	20
B	15	10
C	10	10
D	15	20

Calculate and tabulate the inter-zonal trips for journeys from home to work.

2. (a) Describe the factors governing trip generation and attraction rates. (10)
- (b) Discuss the importance and application of trip assignment stage in transportation modeling. (8)
- (c) What is "3C Process" in transportation planning in the context of USA? (7)
- (d) Describe the real (on ground) implication or results of transportation studies, projects or strategies so far undertaken for Dhaka. (10)

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3. (a) How can transportation system and services result in compact and sprawl development in city. (7)
- (b) Metro rail is being built in Dhaka along MRT-6 corridor. What would be the potential environmental and landuse impacts of this development? Describe. (10)
- (c) There are different types of risks associated before and after the development of any transportation project. Identify and explain them. (18)
4. (a) Discuss the characteristics of transport supply. (10)
- (b) Describe the four aspects based on which any transport intervention should be appraised. (13)
- (c) Data in the table below show travel data between a suburban zone 'S' and another zone 'D'. The exponent value for the impedance factor is 2.0 and monthly median income is Tk. 24,000. Determine the expected percentage of auto and transit trips. (12)

	Auto	Transit
Distance	10 mile	8 mile
Cost per mile	Tk. 8.00	Tk. 1.00
Excess time	5 min	8 min
Parking cost	Tk. 5 (or Tk. 2.5/trip)	---
Speed	30 mile/hr	20 mile/hr

Where, $MS_a = MS_{auto} = \left[\frac{I_{ijt}^b}{I_{ijt}^b + I_{ija}^b} \right]$

$MS_t = MS_{transit} = \left[\frac{I_{ija}^b}{I_{ijt}^b + I_{ija}^b} \right]$

MS_t = Proportion of trips between zone i and j, using transit

MS_a = Proportion of trips between zone i and j, using auto

I_{ijm} = a value referred to as the impedance of of travel of mode 'm', between zone 'i' and 'j', which is a measure of total cost of trip.

m = 't' for transit mode; 'a' for auto

b = an exponent, which depend on trip purpose

Impedence = (in-vehicle time, min) + [(2.5) (excess time, min) + {(3) (trip cost) ÷ (income earned per min)}].

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Give the probable reasons why the quality of highways deteriorates in a short period in Bangladesh. (20)
(b) How can the number of accidents on highways be reduced in Bangladesh. (15)
6. (a) What are the types of railway gauge and what factors affect the choice of type? (15)
(b) Describe the methods used for controlling the movement of trains. (20)
7. Write notes on any two of the three topics below: (2×17 1/2=35)
(a) A brief history of transportation development in Bangladesh between 1862 and 1971.
(b) Padma multi-purpose bridge.
(c) Domestic air transport service in Bangladesh.
8. (a) State the limitations of ports of Bangladesh. (15)
(b) Discuss the benefits of giving transit facilities to the neighbouring countries of Bangladesh. (20)
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