L-3/T-2/BURP **Date : 28/03/2020**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Urp. Examinations 2019-2020

Sub : **PLAN 331** (Rural Development Planning I)

Full Marks : 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) As an interesting entrepreneurial development, NGOs in Bangladesh are working in the commercial sector. Explain how their commercial activities contribute to the development of rural people. Use appropriate example. **(20)**

   (b) There are different approaches of poverty measurement related to income, consumption, human capabilities, empowerment, and participation. Discuss how measure for poverty reduction in rural areas will vary based on the approaches of poverty measurement. **(15)**

2. (a) One of the objectives of Rural Infrastructure Improvement Project I (RIIP-I) was to encourage women to participate in all aspects of the development process. Explain how different hard and soft measures of RIIP-helped to address this objective. **(20)**

   (b) Discuss the importance of infrastructure provision in rural markets in Bangladesh for both rural areas and the country as a whole. **(15)**

3. (a) In Bangladesh, some of the growth centers were functioning poorly while some of the neighboring rural markets were performing comparatively well. Explain the reason behind this based on growth center identification and selection theories. **(23)**

   (b) "Social business are situated somewhere between profit-maximizing business and the non-profit sector." – Explain. **(12)**

4. (a) The Seventh Five Year Plan 2016-2020 is an up-gradation or extension of the Sixth Five Year Plan 2011-2015. Compare the sectoral strategies of these two plans for agriculture and rural infrastructure development. **(12)**

   (b) The following table (Table-1) contains the monthly household income of Region A and Region B. Compare their poverty condition considering the average household size as 4.5. **(23)**

Table: Monthly household income of Region A and Region B in thousand BDT

Regions	Monthly household income							
Region A	9.48	2.26	27.09	3.49	0.96	22.24	13.65	63.33
Region B	1.8	3.08	24.03	15.72	51	9.92	21.12	
Poverty Line= 163.11 BDT per person per day								

Contd P/2

PLAN 331

SECTION – B

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

5. (a) An Integrated Rural Development (IRD) Program will be adopted for the people living in the drought affected zones for ensuring their access to basic services and sustainable livelihood opportunities. **(15)**

   (i) Explain the suitable IRD model that can be adopted for this purpose.

   (ii) Briefly discuss the activities that can be performed under this IRD model.

   (b) Briefly explain the impacts of COVID-19 on the livelihood capitals of rural people engaged in "Farm" and "Non-farm" activities with diagrams. **(20)**

6. (a) Suppose you are working as a country officer at WHO (World Health Organization). At the beginning of COVID-19 pandamic, you had been assigned to prepare an action plan on "How to create awareness regarding COVID-19 among the people living in remote rural areas." You had to collect information from the rural people in a short time regarding this. **(2+8=10)**

   (i) Between participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA), which one would you choose for collecting information?

   (ii) Briefly explain the reasons behind your choice with examples.

   (b) Explain 'dependency syndrome.' How it worked behind the failure of "Village Agricultural and Industrial Development (V-AID) model"? **(4+5=9)**

   (c) Critically discuss the strategies and institutional mechanism of "Comprehensive Village development Program (CVDP)". **(16)**

7. (a) Briefly discuss the feasibility of compact township in the context of Bangladesh. **(12)**

   (b) "The success of the program of target-group oriented model depends on correct identification of beneficiaries and correct diagnoses of their problems and need". Do you agree with the statement? Justify your answer with examples. **(15)**

   (c) Compare 'Agriculture development' and 'Peasantization of development' as the dimensions of rural development with example. **(8)**

8. (a) You are working as a planner for 'Rural Road development' project in the flood flow zones. Briefly discuss the Participatory Rural Appraisal (PRA) tools you would use in this project. **(20)**

   (b) "Rural-urban linkages play a crucial role in the generation of income, employment and wealth". Do you agree with the statement? Justify your answer with examples. **(9)**

   (c) Briefly discuss the disadvantages of land fragmentation from the context of rural Bangladesh with examples. **(6)**

L-3/T-2/URP **Date: 10/04/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 BURP Examinations 2019-2020

Sub: **PLAN 333** (Regional Development Planning)

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** questions.

1. (a) "Intra-regional planning is more physical plan than inter-regional planning"— explain with example. **(12)**

   (b) Construct input-output matrix and explain it. **(18)**

   (c) What variables are used for measuring 'mass' and 'distance' in gravitational analysis? **(5)**

2. (a) "Stages theory is an extended version of sector theory". — Do you agree? Explain. **(17)**

   (b) what will be the impact of injection of a certain amount of money in Khulna Division? Discuss three major leakages in this regard. **(18)**

3. (a) Sector-wise employment distribution of Region 1 and nation is given in the following table. **(6+7+4=17)**

Sector	Region 1('000)	Nation ('000)
Agriculture	22	350
Service	12	110
Industry	10	60

   From the table, answer the following questions:

   (i) Find the basic sector of the Region 1.

   (ii) Calculate the total basic employment of the Region 1.

   (iii) Calculate the economic based multiplier of the Region 1.

   What does this value mean?

   (b) Explain the components of regional growth in light of shift-share analysis. **(18)**

4. (a) Briefly explain the 'Harris-Todaro Model' with necessary illustrations. **(17)**

   (b) Briefly distinguish between: **(3×6=18)**

   (i) Open and close model in input output analysis

   (ii) Formal and functional region

   (iii) Fast-growing sector and slow-growing sector.

Contd P/2

SECTION – B

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

5. (a) How would you define 'regional resilience'? What strategies would you suggest to ensure regional resilience? Explain. **(8+12=20)**

(b) "Region's economic shock resistance is much greater where the region's spatial structure is 'closely knit'." Explain the statement in the light of the Central Place Theory. **(15)**

6. (a) "Industries use the physical resource base and ultimately determine the stages of economic development of a region." Explain the statement. **(15)**

(b) In 1980s, rural hat-bazars of Bangladesh were considered centre points to foster rural development in the light of Fancois Perroux's Growth Pole Theory. Unfortunately, the approach could not meet the expectation. In recent times, a major policy shift has occured, which brings rural hat-bazars again into the focus for ensuring economic development in rural Bangladesh. Briefly discuss key issues of this policy shift. What measures would you suggest for effective implementation of the new policy? **(10+10=20)**

7. (a) Too much reliance on the particular leading industry may retard the overall development of a region. Do you agree with the statement? Justify your answer in view of the characteristics of leading industries. **(15)**

(b) How 'Isodapens' can provide alternative location options for an industry? Explain with necessary illustrations. **(10)**

(c) SDG target 9.4 tells us to upgrade infrastructure and retrofit industries to make them sustainable by 2030. How upgradation of infrastructure would ensure sustainability in the context of industrial development? Explain briefly. **(10)**

8. (a) A spatial interaction between location A and B can occur only if three fundamental conditions are met. What are those conditions? Explain with necessary illustrations. **(15)**

(b) Policy towards 'greater equalization' is valid, whereas policy of 'pure equalization' is a poor policy. Why? **(10)**

(c) Being a regional planner, what policies would you suggest to reallocate labour spatially? Mention with relevant examples. **(10)**

L-3/T-2/URP **Date: 18/04/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 BURP Examinations 2019-2020

Sub: **PLAN 345** (Transportation Policy and Planning)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

Abbreviations and terms have their usual meaning

The figures in the margin indicate full marks

SECTION – A

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

1. (a) Transport planning and transport policy consideration and outputs are not always the same. Show with examples how objectives and outputs of transport plans and transport polices; and processes of transport plan making and transport policy formulation will be different in the context of Bangladesh, considering road safety. **(9)**

(b) Name the organizations involved in transport related decisions in Bangladesh. State their roles and administrative areas of jurisdictions. **(10)**

(c) Critically discuss the changes in investment in transport sub-sectors with respect to sustainable transport over the last 50 years. Also discuss the effect of changes in allocation among the sub-sectors on the development. **(8+8=16)**

2. (a) What do you understand by 'Gauge Problem' in Bangladesh Railway? Why has the problem arisen? **(7)**

(b) What are the considerations in bridge construction that have implication on water transport movement? Name the organizations involved in different sides on this issue. **(7)**

(c) Do you think RHD Toll Rules, RHD Land Management Policy and RHD Landscaping Policy has any implication for land use planning? Justify your answer briefly. **(7)**

(d) Show and explain relationship between accessibility and mobility with respect to speed and road hierarchy through a graph. What implication does this relationship has in formulating urban transport policies? **(9+5=14)**

3. (a) 'Draft Parking Policy 2019' for Dhaka encourages car use and 'Ridesharing Policy 2018' discourages car ownership". Do you agree? Justify briefly. **(9)**

(b) Briefly reflect on the implication of BRTC Bus Lease Policy 2007' and 'Electric Vehicle Rules 2020' with respect to equity and exclusion in urban transport in Dhaka. **(7)**

(c) Name the transport policies, studies and strategies done for Dhaka and state their timeline. **(10)**

(d) What is the context that latest transport related policy document for Dhaka is required to be revised? **(9)**

Contd P/2

PLAN 345

4. (a) Quantitative definition of mobility and accessibility are diverging while qualitative definitions are more potentially converging, as far as dimensions and issues are concerned. Do you agree with the statement, Justify you answer. **(8)**

(b) What is sustainable transport? **(7)**

(c) How do 'National Land Transport Policy 2004' and 'Multimodal Transport Policy 2013' consider equity and inclusion issues, briefly discuss. **(10)**

(d) Discuss the importance of active and non-motorized transport for Dhaka and other cities in Bangladesh. **(10)**

SECTION – B

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

5. (a) What is the context of the development of transportation modeling? **(15)**

(b) Given are the following data from your local council (Table 1). Use cross-classification analysis to determine the number of trips that will occur in the neighborhood in the future if the estimated number of future households is as shown (Table 2). Use three digits after decimal in the calculations. **(20)**

Table 1: Households income and current trip making

	1		2		3+	
	HH	Trips	HH	Trips	HH	Trips
Low income	350	1,190	5,640	23,124	4,230	19,458
Medium income	675	2,498	6,950	31,275	9,641	47,241
High income	540	2,106	2,420	11,616	3,202	17,291

Table 2: Future households in the neighborhood

	Household size		
	1	2	3+
Low income	105	275	430
Medium income	220	1,222	2,412
High income	90	120	250

6. (a) What do you understand by 'carrot approaches' and 'stick approaches'? Why should they ideally be applied together? **(5+10=15)**

(b) Discuss any two 'Travel Demand Management' measures giving examples. **(20)**

7. (a) What are the contributors to traffic congestion? Describe its effects. **(6+9=15)**

(b) Discuss how concepts of basic economics are applied to transportation economics. **(20)**

8. Write notes on any two of the following topics. **(17 $\frac{1}{2}$ × 2 =35)**

(a) Inventory of facilities

(b) Costs and benefits of 'Non Motorized Transport'

(c) Stochastic equilibrium assignment

L-3/T-2/URP **Date: 02/04/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 BURP Examinations 2019-2020

Sub: **PLAN 393** (Operation Research and Systems Analysis)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

SECTION – A

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

1. (a) Prove that, for a perfectly consistent matrix (A) used in the Analytical Heirachical Process (AHP), A*W=n, where W = Current Weights and n=Dimension of the matrix. **(10)**

   (b) A bridge is operated with a single toll collector. During the peak hours, vehicles arrive at a rate of 48 per hour. The average of vehicles that can be served by the toll collector is 60 per hour. Calculate the average number of vehicles in the queue. **(5)**

   (c) A simple 'T' intersection has two approaches. The cycle length is 1 minute 40 seconds. Approach 1 has the saturation flow of 4400 veh/hr. The green time duration is 1 minute 16 seconds and flow rate is 20 veh/min. Approach 2 has saturation flow of 4000 veh/hr with flow rate 1100 veh/hr. Assume that a D/D/1 queuing system adequately describes the considered intersection. **(8+12=20)**

   (i) Calculate average delay per vehicles for every approach.

   (ii) Optimize the signal timing to minimize the total delay of the intersection.

2. (a) Describe 'Dominant Strategy Solution' and 'Nash Equilibrium' in game theory. State the differences between these two. **(4+6=10)**

   (b) Solve the following game by graphical method assuming that the payoffs are for player Y. **(25)**

		Player Y				
		Y1	**Y2**	**Y3**	**Y4**	**Y5**
Player X	**X1**	3	29	23	16	33
	X2	1	25	19	5	27
	X3	31	13	23	25	3
	X4	27	7	17	19	1

3. (a) Laplace criterion for taking decision under uncertainty is based on the 'Principle of Insufficient Reason' – Explain. **(5)**

Contd P/2

PLAN 393

Contd... Q. No. 3

(b) A researcher wants to perform land suitability analysis for a specific purpose. Three lands are accessible: Land X, Land Y and Land Z. As a part of the process, he has decided to take opinion from two experts (Expert 'A' and Expert 'B'). Two criteria (Criterion 'U' and Criterion 'V') are involved in this case, based on these criteria the experts gave their opinions. Eventually, the following comparison matrices have been developed. Recommend the most suitable land for him using Analytical Hierarchical Process (AHP) and demonstrate the whole process by a diagram. **(30)**

$$X = \begin{array}{c} \\ A \\ B \end{array} \begin{array}{c} \begin{array}{cc} A & B \end{array} \\ \begin{pmatrix} 1 & 2 \\ 1/2 & 1 \end{pmatrix} \end{array}$$

$$Xa = \begin{array}{c} \\ U \\ V \end{array} \begin{array}{c} \begin{array}{cc} U & V \end{array} \\ \begin{pmatrix} 1 & 1/3 \\ 3 & 1 \end{pmatrix} \end{array}$$

$$Xb = \begin{array}{c} \\ U \\ V \end{array} \begin{array}{c} \begin{array}{cc} U & V \end{array} \\ \begin{pmatrix} 1 & 4 \\ 1/4 & 1 \end{pmatrix} \end{array}$$

$$X_{au} = \begin{array}{c} \\ X \\ Y \\ Z \end{array} \begin{array}{c} \begin{array}{ccc} X & Y & Z \end{array} \\ \begin{pmatrix} 1 & 2 & 3 \\ 1/2 & 1 & 2 \\ 1/3 & 1/2 & 1 \end{pmatrix} \end{array}$$

$$X_{av} = \begin{array}{c} \\ X \\ Y \\ Z \end{array} \begin{array}{c} \begin{array}{ccc} X & Y & Z \end{array} \\ \begin{pmatrix} 1 & 2 & 1/2 \\ 1/2 & 1 & 1/3 \\ 2 & 3 & 1 \end{pmatrix} \end{array}$$

$$X_{bu} = \begin{array}{c} \\ X \\ Y \\ Z \end{array} \begin{array}{c} \begin{array}{ccc} X & Y & Z \end{array} \\ \begin{pmatrix} 1 & 4 & 2 \\ 1/4 & 1 & 3 \\ 1/2 & 1/3 & 1 \end{pmatrix} \end{array}$$

Contd P/3

PLAN 393

Contd... Q. No. 3(b)

$$X_{bv} = \begin{array}{c} \\ X \\ Y \\ Z \end{array} \begin{array}{c} \begin{array}{ccc} X & Y & Z \end{array} \\ \begin{pmatrix} 1 & 1/2 & 4 \\ 1/2 & 1 & 3 \\ 1/4 & 1/3 & 1 \end{pmatrix} \end{array}$$

4. (a) Briefly discuss the advantages and disadvantages of 'Fixed Time Control Strategy' for signalized intersection management. **(10)**

(b) Solve the following assignment problem using "North-West Corner Method". Then check whether the distribution is optimum or not in terms of cost using Modified Distribution (MODI) Method. **(5+20=25)**

Distribution booth					
		D_1	D_2	D_3	Supply
Production Camp	S_1	45	75	60	**50**
	S_2	30	40	65	**115**
	S_3	45	15	55	**135**
	Demand	**105**	**70**	**125**	**300**

SECTION – B

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

5. (a) You are given the following data ('Table 1') for a linear programming problem where the objective is to maximize the profit from allocating three resources to two nonnegative activities.

Table 1

Resource	Resource Usage per Unit of Each Activity		Amount of Resource Available
	Activity - 1	Activity - 2	
1	2	1	10
2	3	3	20
3	2	4	20
Contribution per unit	$ 20	$ 30	

Contribution per unit = profit per unit of the activity

(a) Formulate a linear programming model for this problem. **(15)**

(b) Use the simplex method to solve the problem. **(20)**

Contd P/4

PLAN 393

6. (a) Use the graphical method to solve the following problem: **(15)**

Maximum $Z = 10x_1 + 20x_2$

Subject to

$$-x_1 + 2x_2 \leq 15$$
$$x_1 + x_2 \leq 12$$
$$5x_1 + 3x_2 \leq 45$$

and

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

(b) Prove the following equation: **(20)**

$$Z = C_B B^{-1} b$$

7. Solve the following linear programming problem using revised simplex method. **(35)**

Maximize $Z = 3x_1 + 5x_2$

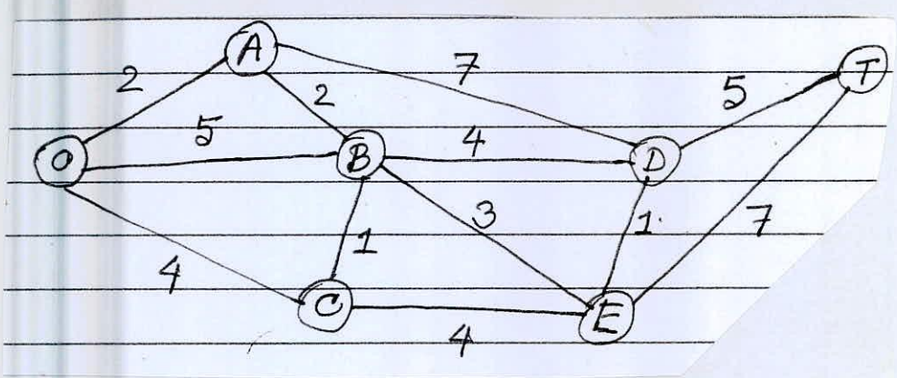
Subject to $x_1 \leq 4$

$2x_2 \leq 12$

$3x_1 + 2x_2 \leq 18$

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

8. Consider the following problem to find the optimum solution using minimum spanning tree. **(35)**



`L-3/T-2/URP **Date: 22/03/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 BURP Examinations 2019-2020

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

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

Assume reasonable values for mission data, if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) List the major components of RCC frame building showing them in a neat sketch. **(4)**

   (b) Why is it necessary to provide clear cover in RCC structures? **(4)**

   (c) A 20" square column supports a dead load of 250 kips and a live load of 150 kips. The soil (fill) has a unit weight of 115 pcf. The allowable soil pressure q_a is 3 ksf. Design a square footing with base 7' below grade, using $f_c' = 4$ ksi and $f_y = 60$ ksi. **(27)**

2. (a) Show five different types of floor systems commonly used in Bangladesh in neat sketches. **(5)**

   (b) A 12' wide and 36' long reinforced concrete slab is built integrally with its supports. The slab is continuous on one end in short direction. The service live load is 75 psf. The dead load consists of 30 psf floor finish load and 25 psf partition wall load in addition to the self-weight of the slab. Design the slab following the provisions of the ACI Code. Assume, $f_c' = 4$ ksi and $f_y = 60$ ksi. **(30)**

3. (a) Show the variation of strength reduction factor with net tensile stain in a neat sketch. **(4)**

   (b) Design a square tied column to support an axial dead load of 775 kips and a live load of 425 kips. Use, $f_c' = 5$ ksi, $f_y = 60$ ksi and a steel ratio of about 3%. Design the necessary ties. **(21)**

   (c) Determine the nominal and design axial compression capacity of a column 30"×40" reinforced with 24-#8 bars. Assume, $f_c' = 4$ ksi and $f_y = 60$ ksi. **(10)**

4. (a) Mention the sources of uncertainties in analysis, design, and construction of reinforced concrete structures. **(7)**

   (b) Why is it necessary to provide a reinforcement ratio more than the minimum reinforcement ratio in beams? Why is it necessary to keep the reinforcement ratio of a beam below the balanced reinforcement ratio? **(8)**

   (c) A beam has a cross-section of 12"×24". It is reinforced with 6-#8 bars. Determine the design moment capacity of the beam. Assume compressive strength of concrete to be 4 ksi and yield stress of steel to be 60 ksi. **(20)**

Contd P/2

CE 363

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.
Necessary tables and formulae are provided.

5. (a) Compare the two design philosophies considered in design of steel structures. **(6)**

(b) Write down the differences between steel and concrete structures. **(9)**

(c) Investigate the tension capacity of the plate (PL $7 \times \frac{1}{2}$) attached to a gusset plate as shown in Figure 1. The bolts are $\frac{1}{2}$ inch in diameter and the material is A36 (F_y = 36 ksi, F_u = 58 ksi). Use both LRFD and ASD method. **(20)**

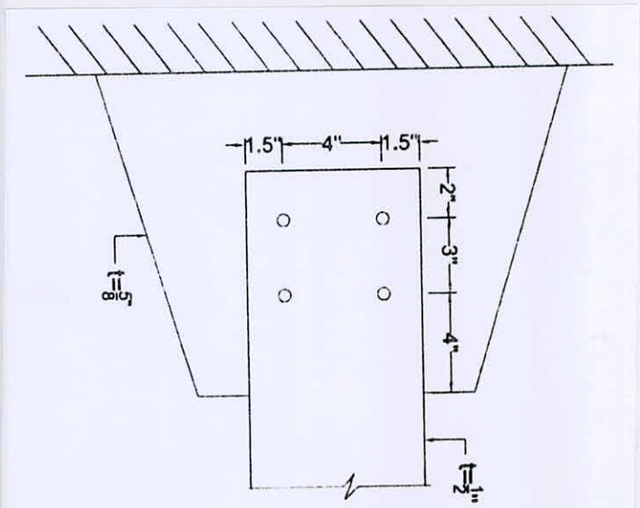


Figure 1

6. (a) What is welding? Describe briefly about different types of weld and welded joint with neat sketches. **(10)**

(b) Design the fillet weld to develop the full strength of the angle shown in Figure 2 and show the welds on a sketch with dimensions. Follow AISC LRFD method and assume gusset plate does not govern. Material A36: F_y = 50 ksi, F_u = 65 ksi. Use E70XX electrode. **(25)**

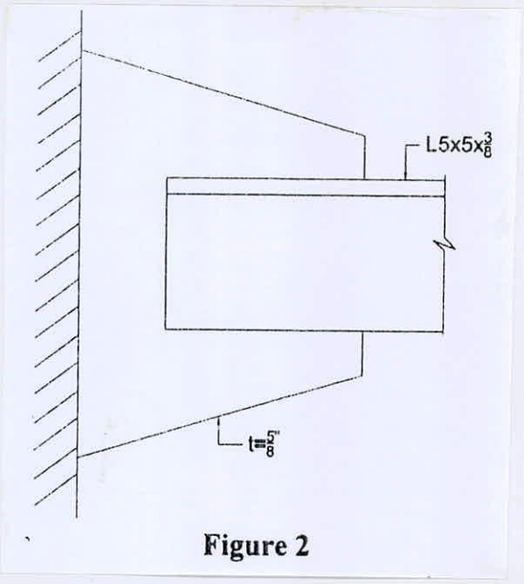


Figure 2

Contd P/3

CE 363

7. (a) Show different types of block shear failure with figure. **(5)**

(b) Write the advantages and disadvantages of steel structure as a building material. **(10)**

(c) What is the magnitude of the live load which the bolted connection shown in Figure 3 can resist if the dead load is 50 kip. Consider bearing and shear stress of bolts only. The bolts are $\frac{3}{4}$ inch in diameter, A490 (F_{by} = 130 ksi, F_{bu} = 150 ksi and all plates are A36 steel (F_y = 36 ksi, F_u = 58 ksi). **(20)**

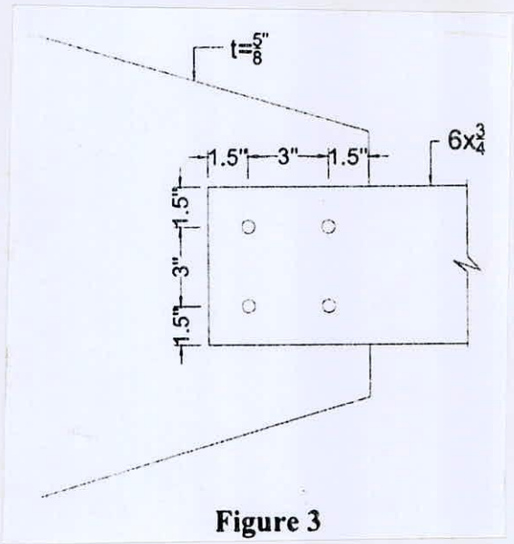


Figure 3

8. (a) Define local buckling and briefly describe different types of steel sections based on width-thickness ratio. **(8)**

(b) What are the assumptions of an ideal column? **(9)**

(c) Select a standard W shape of A992 steel (F_y = 50 ksi) for a simply supported beam of span 20 ft carrying a uniformly distributed live load of 2.1 k/ft and dead load of 0.8 k/ft in addition to its own weight. The compression flange of the beam is fully supported lateral movement. Follow ASD principle. **(18)**

Annexure 1

Table 1-7 (continued)
Angles
Properties

L6-L4

Shape	Axis Y-Y						Axis Z-Z				Q_s
	I	S	r	$\bar{x}$	Z	x_p	I	S	r	Tan α	$F_y = 36$ ksi
	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.		
L6×4×7/8	9.70	3.37	1.10	1.12	6.26	0.667	5.82	2.91	0.854	0.421	1.00
×3/4	8.63	2.95	1.12	1.07	5.42	0.578	5.08	2.51	0.856	0.428	1.00
×5/8	7.48	2.52	1.13	1.03	4.56	0.488	4.32	2.12	0.859	0.435	1.00
×9/16	6.86	2.29	1.14	1.00	4.13	0.443	3.93	1.92	0.861	0.438	1.00
×1/2	6.22	2.06	1.14	0.981	3.69	0.396	3.54	1.72	0.864	0.440	1.00
×7/16	5.56	1.83	1.15	0.957	3.24	0.348	3.14	1.51	0.867	0.443	0.973
×3/8	4.86	1.58	1.16	0.933	2.79	0.301	2.73	1.31	0.870	0.446	0.912
×5/16	4.13	1.34	1.17	0.908	2.33	0.253	2.31	1.10	0.874	0.449	0.826
L6×3 1/2×1/2	4.24	1.59	0.968	0.829	2.88	0.375	2.59	1.34	0.756	0.343	1.00
×3/8	3.33	1.22	0.984	0.781	2.18	0.287	2.01	1.02	0.763	0.349	0.912
×5/16	2.84	1.03	0.991	0.756	1.82	0.241	1.70	0.859	0.767	0.352	0.826
L5×5×7/8	17.8	5.16	1.49	1.56	9.31	0.800	7.60	3.43	0.971	1.00	1.00
×3/4	15.7	4.52	1.50	1.52	8.14	0.698	6.55	3.08	0.972	1.00	1.00
×5/8	13.6	3.85	1.52	1.47	6.93	0.590	5.62	2.70	0.975	1.00	1.00
×1/2	11.3	3.15	1.53	1.42	5.66	0.479	4.64	2.29	0.980	1.00	1.00
×7/16	10.0	2.78	1.54	1.40	5.00	0.422	4.04	2.06	0.983	1.00	1.00
×3/8	8.76	2.41	1.55	1.37	4.33	0.365	3.55	1.83	0.986	1.00	0.983
×5/16	7.44	2.04	1.56	1.35	3.65	0.307	3.00	1.58	0.990	1.00	0.912
L5×3 1/2×3/4	5.52	2.20	0.974	0.993	4.07	0.585	3.23	1.90	0.744	0.464	1.00
×5/8	4.80	1.88	0.987	0.947	3.43	0.493	2.74	1.60	0.746	0.472	1.00
×1/2	4.02	1.55	1.00	0.901	2.79	0.400	2.26	1.29	0.750	0.479	1.00
×3/8	3.15	1.19	1.02	0.854	2.12	0.305	1.73	0.985	0.755	0.485	0.983
×5/16	2.69	1.01	1.02	0.829	1.77	0.256	1.47	0.827	0.758	0.489	0.912
×1/4	2.20	0.816	1.03	0.804	1.42	0.207	1.19	0.667	0.761	0.491	0.804
L5×3×1/2	2.55	1.13	0.824	0.746	2.08	0.375	1.55	0.953	0.642	0.357	1.00
×7/16	2.29	1.00	0.831	0.722	1.82	0.331	1.37	0.840	0.644	0.361	1.00
×3/8	2.01	0.874	0.838	0.698	1.57	0.286	1.20	0.726	0.646	0.364	0.983
×5/16	1.72	0.739	0.846	0.673	1.31	0.241	1.01	0.610	0.649	0.368	0.912
×1/4	1.41	0.600	0.853	0.648	1.05	0.194	0.825	0.491	0.652	0.371	0.804
L4×4×3/4	7.62	2.79	1.18	1.27	5.02	0.680	3.25	1.81	0.774	1.00	1.00
×5/8	6.62	2.38	1.20	1.22	4.28	0.576	2.76	1.59	0.774	1.00	1.00
×1/2	5.52	1.96	1.21	1.18	3.50	0.469	2.25	1.35	0.776	1.00	1.00
×7/16	4.93	1.73	1.22	1.15	3.10	0.413	1.99	1.22	0.777	1.00	1.00
×3/8	4.32	1.50	1.23	1.13	2.69	0.358	1.73	1.08	0.779	1.00	1.00
×5/16	3.67	1.27	1.24	1.11	2.26	0.300	1.46	0.936	0.781	1.00	0.997
×1/4	3.00	1.03	1.25	1.08	1.82	0.241	1.19	0.776	0.783	1.00	0.912

Note: For workable gages, refer to Table 1-7A. For compactness criteria, refer to Table 1-7B.

Annexure 2

Minimum size of fillet weld	
Minimum fillet weld size (inch)	Maximum thickness of part (inch)
1/8	To ¼ inclusive
3/16	Over ¼ to ½
1/4	Over ½ to ¾
5/16	Over ¾ to 1½
3/8	Over 1½ to 2¼
1/2	Over 2¼ to 6
5/8	Over 6

Annexure 3

Maximum size of fillet weld	
Maximum fillet weld size (inch)	Minimum thickness of part (inch)
Thickness of material	To ¼ inclusive
(Thickness of material -1/16 inch)	¼ inch & over ¼ inch

Annexure 4

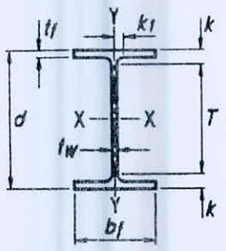


Table 1-1 (continued)
W-Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Workable Gage
											k_{des}	k_{det}			
	in.^{2}	in.		in.		in.	in.		in.		in.		in.	in.	in.
W12×58	17.0	12.2	12 1/4	0.360	3/8	3/16	10.0	10	0.640	5/8	1.24	1 1/2	15/16	9 1/4	5 1/2
×53	15.6	12.1	12	0.345	3/8	3/16	10.0	10	0.575	9/16	1.18	1 3/8	15/16	9 1/4	5 1/2
W12×50	14.6	12.2	12 1/4	0.370	3/8	3/16	8.08	8 1/8	0.640	5/8	1.14	1 1/2	15/16	9 1/4	5 1/2
×45	13.1	12.1	12	0.335	5/16	3/16	8.05	8	0.575	9/16	1.08	1 3/8	15/16	↓	↓
×40	11.7	11.9	12	0.295	5/16	3/16	8.01	8	0.515	1/2	1.02	1 3/8	7/8		
W12×35[c]	10.3	12.5	12 1/2	0.300	5/16	3/16	6.56	6 1/2	0.520	1/2	0.820	1 3/16	3/4	10 1/8	3 1/2
×30[c]	8.79	12.3	12 3/8	0.260	1/4	1/8	6.52	6 1/2	0.440	7/16	0.740	1 1/8	3/4	↓	↓
×26[c]	7.65	12.2	12 1/4	0.230	1/4	1/8	6.49	6 1/2	0.380	3/8	0.680	1 1/16	3/4		
W12×22[c]	6.48	12.3	12 1/4	0.260	1/4	1/8	4.03	4	0.425	7/16	0.725	15/16	5/8	10 3/8	2 1/4[g]
×19[c]	5.57	12.2	12 1/8	0.235	1/4	1/8	4.01	4	0.350	3/8	0.650	7/8	9/16	↓	↓
×16[c]	4.71	12.0	12	0.220	1/4	1/8	3.99	4	0.265	1/4	0.565	13/16	9/16		
×14[c,v]	4.16	11.9	11 7/8	0.200	3/16	1/8	3.97	4	0.225	1/4	0.525	3/4	9/16		
W10×112	32.9	11.4	11 3/8	0.755	3/4	3/8	10.4	10 3/8	1.25	1 1/4	1.75	1 15/16	1	7 1/2	5 1/2
×100	29.3	11.1	11 1/8	0.680	11/16	3/8	10.3	10 3/8	1.12	1 1/8	1.62	1 13/16	1		
×88	26.0	10.8	10 7/8	0.605	5/8	5/16	10.3	10 1/4	0.990	1	1.49	1 11/16	15/16		
×77	22.7	10.6	10 5/8	0.530	1/2	1/4	10.2	10 1/4	0.870	7/8	1.37	1 9/16	7/8		
×68	19.9	10.4	10 3/8	0.470	1/2	1/4	10.1	10 1/8	0.770	3/4	1.27	1 7/16	7/8		
×60	17.7	10.2	10 1/4	0.420	7/16	1/4	10.1	10 1/8	0.680	11/16	1.18	1 3/8	13/16		
×54	15.8	10.1	10 1/8	0.370	3/8	3/16	10.0	10	0.615	5/8	1.12	1 5/16	13/16		
×49	14.4	10.0	10	0.340	5/16	3/16	10.0	10	0.560	9/16	1.06	1 1/4	13/16	↓	↓
W10×45	13.3	10.1	10 1/8	0.350	3/8	3/16	8.02	8	0.620	5/8	1.12	1 5/16	13/16	7 1/2	5 1/2
×39	11.5	9.92	9 7/8	0.315	5/16	3/16	7.99	8	0.530	1/2	1.03	1 3/16	13/16	↓	↓
×33	9.71	9.73	9 3/4	0.290	5/16	3/16	7.96	8	0.435	7/16	0.935	1 1/8	3/4		
W10×30	8.84	10.5	10 1/2	0.300	5/16	3/16	5.81	5 3/4	0.510	1/2	0.810	1 1/8	11/16	8 1/4	2 3/4[g]
×26	7.61	10.3	10 3/8	0.260	1/4	1/8	5.77	5 3/4	0.440	7/16	0.740	1 1/16	11/16	↓	↓
×22[c]	6.49	10.2	10 1/8	0.240	1/4	1/8	5.75	5 3/4	0.360	3/8	0.660	15/16	5/8		
W10×19	5.62	10.2	10 1/4	0.250	1/4	1/8	4.02	4	0.395	3/8	0.695	15/16	5/8	8 3/8	2 1/4[g]
×17[c]	4.99	10.1	10 1/8	0.240	1/4	1/8	4.01	4	0.330	5/16	0.630	7/8	9/16	↓	↓
×15[c]	4.41	9.99	10	0.230	1/4	1/8	4.00	4	0.270	1/4	0.570	13/16	9/16		
×12[c,f]	3.54	9.87	9 7/8	0.190	3/16	1/8	3.96	4	0.210	3/16	0.510	3/4	9/16		

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination and orientation of fastener components should be compared with the geometry of the cross section to ensure compatibility.
[v] Shape does not meet the h/t_w limit for shear in AISC *Specification* Section G2.1(a) with F_y = 50 ksi.

Annexure 4 (contd.)

Table 1-1 (continued)
W-Shapes
Properties

W12-W10

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
58	7.82	27.0	475	78.0	5.28	86.4	107	21.4	2.51	32.5	2.81	11.6	2.10	3570
53	8.69	28.1	425	70.6	5.23	77.9	95.8	19.2	2.48	29.1	2.79	11.5	1.58	3160
50	6.31	26.8	391	64.2	5.18	71.9	56.3	13.9	1.96	21.3	2.25	11.6	1.71	1880
45	7.00	29.6	348	57.7	5.15	64.2	50.0	12.4	1.95	19.0	2.23	11.5	1.26	1650
40	7.77	33.6	307	51.5	5.13	57.0	44.1	11.0	1.94	16.8	2.21	11.4	0.906	1440
35	6.31	36.2	285	45.6	5.25	51.2	24.5	7.47	1.54	11.5	1.79	12.0	0.741	879
30	7.41	41.8	238	38.6	5.21	43.1	20.3	6.24	1.52	9.56	1.77	11.9	0.457	720
26	8.54	47.2	204	33.4	5.17	37.2	17.3	5.34	1.51	8.17	1.75	11.8	0.300	607
22	4.74	41.8	156	25.4	4.91	29.3	4.66	2.31	0.848	3.66	1.04	11.9	0.293	164
19	5.72	46.2	130	21.3	4.82	24.7	3.76	1.88	0.822	2.98	1.02	11.9	0.180	131
16	7.53	49.4	103	17.1	4.67	20.1	2.82	1.41	0.773	2.26	0.983	11.7	0.103	96.9
14	8.82	54.3	88.6	14.9	4.62	17.4	2.36	1.19	0.753	1.90	0.961	11.7	0.0704	80.4
112	4.17	10.4	716	126	4.66	147	236	45.3	2.68	69.2	3.08	10.2	15.1	6020
100	4.62	11.6	623	112	4.60	130	207	40.0	2.65	61.0	3.04	10.0	10.9	5150
88	5.18	13.0	534	98.5	4.54	113	179	34.8	2.63	53.1	2.99	9.81	7.53	4330
77	5.86	14.8	455	85.9	4.49	97.6	154	30.1	2.60	45.9	2.95	9.73	5.11	3630
68	6.58	16.7	394	75.7	4.44	85.3	134	26.4	2.59	40.1	2.92	9.63	3.56	3100
60	7.41	18.7	341	66.7	4.39	74.6	116	23.0	2.57	35.0	2.88	9.52	2.48	2640
54	8.15	21.2	303	60.0	4.37	66.6	103	20.6	2.56	31.3	2.85	9.49	1.82	2320
49	8.93	23.1	272	54.6	4.35	60.4	93.4	18.7	2.54	28.3	2.84	9.44	1.39	2070
45	6.47	22.5	248	49.1	4.32	54.9	53.4	13.3	2.01	20.3	2.27	9.48	1.51	1200
39	7.53	25.0	209	42.1	4.27	46.8	45.0	11.3	1.98	17.2	2.24	9.39	0.976	992
33	9.15	27.1	171	35.0	4.19	38.8	36.6	9.20	1.94	14.0	2.20	9.30	0.583	791
30	5.70	29.5	170	32.4	4.38	36.6	16.7	5.75	1.37	8.84	1.60	9.99	0.622	414
26	6.56	34.0	144	27.9	4.35	31.3	14.1	4.89	1.36	7.50	1.58	9.86	0.402	345
22	7.99	36.9	118	23.2	4.27	26.0	11.4	3.97	1.33	6.10	1.55	9.84	0.239	275
19	5.09	35.4	96.3	18.8	4.14	21.6	4.29	2.14	0.874	3.35	1.06	9.81	0.233	104
17	6.08	36.9	81.9	16.2	4.05	18.7	3.56	1.78	0.845	2.80	1.04	9.77	0.156	85.1
15	7.41	38.5	68.9	13.8	3.95	16.0	2.89	1.45	0.810	2.30	1.01	9.72	0.104	68.3
12	9.43	46.6	53.8	10.9	3.90	12.6	2.18	1.10	0.785	1.74	0.983	9.66	0.0547	50.9