

Sub: **PLAN 321** (Housing and Real Estate Development)

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) Outline the scope of housing as understood by planners. (12)
- (b) Compare how life cycle model of housing for the people in a country like ours is different from that of the people in countries with developed economy. (12)
- (c) Evaluate from policy perspective, which approach(es) are followed in Housing Policy 2016 of Bangladesh? (11)
2. (a) Define housing stress with examples. (3+3=6)
- (b) Interpret how can understanding of life cycle model of housing help in fixing housing location choice. (9)
- (c) Investigate why a plot owner in Bangladesh is unable or reluctant to get housing finance from banks or formal housing finance institutions. (10)
- (d) Assess neighbourhoods and housing areas in our cities with respect to the issue of health and housing. (10)
3. (a) Explain how a city plan can affect the quality and quantity of housing in a city. (9)
- (b) "Housing typology may be defined based on delivery system, tenure type, construction material and placement of dwelling units on single or attached plots." Compare the implication of the differences in classifying housing on urban land use planning. (8)
- (c) Critique the role of housing supply related stakeholders in Bangladesh with respect to their understanding and function related to housing. (8)
- (d) Compare policy applications of different measures of housing affordability. (10)
4. (a) Compile some measures through which assurance of housing for the low income people can be embedded in the plot based housing or site and services schemes undertaken by government and non-government agencies in Bangladesh. (10)
- (b) Discuss different measures and concepts of housing affordability. (10)
- (c) Describe different steps of housing need and demand calculation for a city. (15)

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**SECTION – B**

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

5. (a) "Housing is different from other goods for its heterogeneity, immobility, durability and associated high costs" — do you agree with the statement? Justify your answer with examples. (10)
- (b) How does the heterogeneity of dwelling affect the choice of housing? Explain with examples. (10)
- (c) Briefly explain real estate trade cycle with proper illustrations. (15)
6. (a) What are the factors affecting the structural vacancy of housing? Discuss both from home-owner's and tenant's perspective. (20)
- (b) Based on "Filtering model of housing", explain how a dwelling unit moves down the quality ladder to households with progressively lower income. State two limitations of this model. (11+4=15)
7. (a) Suppose you are working as a planner in a real estate development agency. List any five legal documents associated with real estate sector of Bangladesh that you must know while working as a planner. (10)
- (b) Mention different types of property rights associated with real estate. (5)
- (c) "The effluent fee policy is more efficient than zoning policy. But cities use zoning policy instead of effluent fee policy"— do you agree with the statement? Justify your answer with examples. (10)
- (d) Suppose you have been working as a research officer at National Housing Authority (NHA). You have been appointed to submit an evaluation report on "Low-income housing for urban poor at Kanail slum". Briefly explain the stages you would follow for the real estate project's efficiency evaluation. (10)
8. Write short notes on the following topics— (5×7=35)
- (a) Pipeline effect
  - (b) Implicit price
  - (c) Myopic expectation
  - (d) Gross absorption
  - (e) Ricardian rent
  - (f) General warranty deed
  - (g) Housing vouchers.
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**SECTION – A**

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

1. (a) Urban/build-up and rural/open area transport dynamics are distinct from each other" — do you agree with the statement? Explain with relevant examples. (10)
- (b) Illustrate with appropriate diagram why anti-clockwise rotation of traffic signal is efficient. (12)
- (c) Calculate the estimated traffic flow rates using the manual count traffic volume data provided below [counts are taken for 4 minutes during each 5 minutes counting period. Assume that the flow rate in the short interval is the same as the observed period]. (13)

Table: Annual count traffic volume field survey data

Period	Time (PM)	Actual Counts (vehs)	
		Lane 1	Lane 2
1	8.30 AM	33	
2	8.35 AM		29
3	8.40 AM	37	
4	8.45 AM		33
5	8.50 AM	43	
6	8.55 AM		37
7	9.00 AM	45	
8	9.05 AM		43
9	9.10 AM	42	
10	9.15 AM		40
11	9.20 AM	40	
12	9.25 AM		39

2. (a) What is the main transportation problem in urban areas? Describe the configuration of an efficient and sustainable transport system in terms of geometric capacity and operational capacity. (10)
- (b) "Left channelization reduces the junction size as well as improves the efficiency and traffic safety" — explain the statement with relevant illustration. (12)

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(c) Following tables contain the moving observer traffic survey data of a 5 km long road section. Calculate the followings (assume the equivalency factor of one per car, two per truck, and three per bus for PCU calculation)—

(13)

- (i) Flow in PCU/hour in both directions.
- (ii) Journey speed and running speed in km/hour for both directions.

Journey: Northbound							
Run No.	Journey Time (minutes)	Stopped Time (minutes)	Vehicles met with in the opposing direction			Vehicles in the same direction	
			Car	Truck	Bus	Overtaking Vehicles	Overtaken Vehicles
1	5.6	1.01	40	10	12	4	2
2	6.7	2.5	24	13	13	6	3
3	4.89	0.5	25	16	11	7	2
4	9.01	3.4	35	12	14	8	1
5	12.05	4.89	48	14	9	5	4
6	7.56	2.56	55	18	10	3	5

Journey: Southbound							
Run No.	Journey Time (minutes)	Stopped Time (minutes)	Vehicles met with in the opposing direction			Vehicles in the same direction	
			Car	Truck	Bus	Overtaking Vehicles	Overtaken Vehicles
1	8	2.02	32	14	22	4	4
2	5.31	1.01	38	16	25	5	3
3	5.76	2.56	35	13	24	6	5
4	12.03	4.53	48	21	31	9	3
5	7.9	3.49	30	19	21	7	4
6	5.6	1.59	39	18	18	4	7

3. (a) For a three-leg interchange design in Bangladesh which trumpet interchange (left or right) will you favor most if there is not enough space? Please explain with the necessary illustrations.

(10)

(b) Draw and count the potential conflict point of a diverging diamond interchange.

(12)

(c) Origin-destination count data using the license-plate method as well as the full-volume counts observed on each entry and exit leg for a small town are provided below. Please perform the necessary adjustment through iteration until all row and column totals of O-D matrix are within 10% at the measured volume.

(13)

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**Contd... for Q. No. 3(c)**

Table: Data from an Origin-Destination count using license-plate matching

Destination Zone	Origin Zone				T <sub>j</sub>	V <sub>j</sub>
	1	2	3	4		
1	30	100	50	70	250	390
2	80	40	32	87	239	502
3	55	62	25	96	238	700
4	89	74	63	21	247	370
T <sub>i</sub>	254	276	170	274	974	
V <sub>i</sub>	604	395	346	617		1962

4. (a) Define the terms: (i) parking accumulation, (ii) parking load, (iii) parking duration, (iv) parking index and (v) parking turnover. (10)
- (b) Please answer the following short questions: (5×5=25)
- (i) Describe the "Enscope method" of spot speed study with illustration.
  - (ii) "Volume is what is, demand is what motorists would like to be, and capacity is the physical limit of what is possible" — describe the statement.
  - (iii) Describe the urban form and urban spatial structure in the context of transportation planning.
  - (iv) Describe different types of traffic signs.
  - (v) Describe the factors of accidents.

**SECTION – B**

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

5. (a) Explain the transportation system from the consideration of a hypothetical trip. (17)
- (b) What do you understand by equity? How would you propose to solve transportation issues of Dhaka city from equity consideration? (6+12=18)
6. (a) One aerial photograph was taken in the westbound direction of the Dhaka-Mawa Expressway at 12:30 pm and another at 12:32 pm. The positions of seven vehicles were recorded in the two photographs as follows: (25)

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**Contd... for Q. No. 6(a)**

Vehicle	Positions (meter)	
	Photo 1	Photo 2
1	3825	5050
2	3230	4150
3	2340	3225
4	2125	3415
5	910	2125
6	565	1445
7	0	990

Plot the trajectories on a graph paper. Compute average flow, density, and speed over the 5.5 km length of the lane.

(b) Explain the differences between time headway and spacing with diagrams and equations. (10)

7. (a) How are urban roads categorized? Describe the features of different categories of urban roads. (5+15=20)

(b) Discuss the road section between the Science Laboratory and Nilkhet intersections from a traffic management perspective. (15)

8. Write notes on any TWO of the following topics: (17 ½ × 2 = 35)

- (a) Public transportation service hierarchy
  - (b) Benefits of walking
  - (c) Mixed land use and transportation.
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## BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 BURP Examinations 2020-2021

Sub: **HUM 225** (Accounting)

Full Marks: 140

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** questions.

1. (a) What are the elements of financial statements? Write down the characteristics of these elements.

 $(3 \frac{1}{3})$ 

- (b) Maureen -Enterprise has the following transactions on May 2021:

(20)

May 1 :	The owner Invested cash into the business.	Tk. 10,00,000.
May 2 :	Advertisement expenses incurred on account	Tk. 50,000.
May 5 :	Purchase supplies for cash	Tk. 60,000.
May 10 :	Purchase office equipment for Tk. 2,50,000, paying Tk. 50,000 in cash and remaining on account.	
May 12 :	Service provided on account	Tk. 3,00,000.
May 15 :	Owner withdrew cash for personal use	Tk. 10,000.
May 18 :	Salary for the month paid in cash	Tk. 25,000.
May 20 :	Paid balance due for advertisement expenses.	
May 22 :	Cash received from customer for May 12 transaction.	
May 24 :	Provide services for cash	Tk. 20,000.

Required:

- (i) Show the effects of the above transactions in the Accounting Equation:

Assets = Liabilities + Owner's Equity

2. (a) Who are the external users of accounting information? How does financial accounting provides relevant data/information to these users?

 $(3 \frac{1}{3})$ 

- (b) Mr. Wasiq started his own business "Wasiq Enterprise" on June 1, 2022. The following transactions were completed during the month:

(20)

Contd ..... P/2

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**Contd... Q. No. 2(b)**

- June - 1 : Wasiq invested Tk. 15,000 cash to start the enterprise.
- June - 2 : Paid Tk. 600 cash for June office rent.
- June - 11 : Purchased office equipment for Tk. 3000 cash.
- June - 14 : Incurred Tk. 700 advertising cost in the Daily News, on account.
- June - 17 : Paid Tk. 800 cash for office supplies.
- June - 19 : Earned Tk. 11,000 for services rendered, Tk. 3000 cash is received from clients and the balance of Tk. 8000 is billed to clients on account.
- June - 23 : Withdrew Tk. 500 cash by Mr. Wasiq for personal use.
- June - 28 : Paid to the Daily News amount due in the transaction of June 14.
- June - 29 : Paid employee's salaries Tk. 2,200.
- June - 30 : Received Tk. 4,000 in cash from clients who were previously billed (in connection of June-19)

Required:

Journalise the above transactions in a good form.

3. The trial balance for 'Ishart Group' is as follows:

(23  $\frac{1}{3}$ )

Ishart Group  
Trial Balance  
December 31, 2019

Accounts Title	Debit (Tk.)	Credit (Tk.)
Cash	30,000	---
Accounts receivable	20,500	
Accounts Payable	---	11,000
Ishrat's capital	---	50,800
Office Equipment	25,000	
Service Revenue		30,000
Salaries Expenses	12,000	
Prepaid Rent Expenses	4,000	
Advertisement Expenses	1,000	
Utilities Expenses	3,000	
Notes - Payable	700	
Drawings	--	6,400
	2000	
<b>Total :</b>	<b>98,200</b>	<b>98,200</b>

Adjustments:

\* Supplies on hand at December 31, 2019 Tk. 350.

\* Salary was unpaid during the period Tk. 2,000.

Required:

Prepare (i) an income statement,

(ii) An owner's equity statement, and

(iii) A balance sheet at December 31, 2019.



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4. (a) What is "Revenue Recognition Principles"?

(3 <sup>1</sup>/<sub>3</sub>)

(b) The following are the account balances of Standard Real Estate Business Limited for the year ended on 31<sup>st</sup> December 2015:

(16)

Accounts Title	Tk.	Accounts Title	Tk.
Cash in hand	55,000	Unpaid advertisement expenses	40,000
Cash at bank	8,50,000	Accounts receivable	350,000
Accounts payable	450,000	Land & Building	30,00,000
Salaries Expenses	21,00,000	Bank Loan	35,00,000
Office rent Expenses	240,000	Machinery	32,00,000
Land Development Expenses	24,00,000	Furniture & fittings	450,000
Sales Revenue	80,00,000	Office expenses	150,000
Utilities Expenses	240,000	VAT payable	170,000
Depreciation Expenses	310,000	Vehicle	950,000
Internet Expenses	700,000	Capital	18,90,000
Insurance Expenses	60,000	Consulting fees received	600,000

**Required:**

Prepare a trial balance.

(c) Differentiate between:

(4)

- (i) Prepaid Insurance & Insurance Expenses
- (ii) Salary expenses and salary payable.

**SECTION – B**

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

5. (a) Distinguish between manufacturing overhead, administrative overhead, and selling and distribution overhead with examples.

(3 <sup>1</sup>/<sub>3</sub>)

(b) Listed below are the number of costs typically found in organizations:

(5)

- (i) Clay used in brick production
- (ii) Boxes used for packing detergent
- (iii) Wages of workers assembling furniture
- (iv) Advertising by a dental office
- (v) Microchips used in the production of calculators

**Required:**

Classify each item as fixed, variable or mixed cost.

(c) Fast Parcel Service operates a fleet of delivery trucks in large metropolitan area. A careful study by the company's cost analyst has determined that if a truck is driven 120,000 miles during a year, the average operating cost is Tk. 11.6 per mile. If a truck is driven only 80,000 miles during a year, the average operating cost increases to Tk. 13.6 per mile.

(15)

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**Contd... Q. No. 5(c)**

**Required:**

- (i) Using the high-low point method, determine the variable cost per mile driven and fixed operating cost of truck operation during a year.
- (ii) Express the variable cost and fixed cost element in the form of  $Y = mx + c$ .
- (iii) If a truck is driven 100,000 miles during a year, what total operating cost would you expect to be incurred?

6. (a) Various cost data and sales data for Strafford Company for the just ended year are as follows:

**(18)**

Selling expenses	110,000
Rent for showroom	30,000
Beginning raw materials	90,000
Ending raw materials	60,000
Utilities, factory	36,000
Direct labor	300,000
Depreciation, plant equipment (factory)	162,000
Purchase of raw materials	750,000
Sales	3,000,000
Insurance for factory	40,000
Indirect labor	150,000
Maintenance for plant equipment (factory)	87,000
Officer's salary	50,000
Directors' fee	130,000
Supervisor's salary	40,000
Advertisement expenses	45,000
Sales manager's salary	20,000
Beginning work-in-process	180,000
Ending work-in-process	100,000
Beginning finished goods	260,000
Ending finished goods	210,000
Cleaning supplies, factory	7,000
Rent (67% factory and 33% office)	120,000
Gas and water, factory	2,500
Travelling expenses, factory	6,000
Travelling expenses, office	7,000

**Required:**

- (i) Prepare a cost of goods sold statement in a good form.
- (ii) Prepare an income statement.

**HUM 225**  
**Contd... Q. No. 6**

(b) "Manufacturing cost is composed of three components – direct materials, direct labor and manufacturing overhead." Give example of each component for an electric bulbs manufacturing plant.

(5  $\frac{1}{3}$ )

7. Starwood Company produces memory enhancement kits for fax machines. The company's income statement for the most recent year is given below:

(23  $\frac{1}{3}$ )

Sales (12,400 units @ Tk. 20 per unit)	Tk. 248,000
Less: Variable cost of sales	189,000
Contribution margin	59,000
Less: Fixed cost for the period	60,000
Network operating loss	<u>Tk. (1,000)</u>

**Required:**

- (i) Compute the company's CM ratio and its break-even point in both units and amount.
- (ii) The sales manager feels that Tk. 8,000 increase in the advertising cost will result in a Tk. 70,000 increase in sales. If the sales manager is right, what will be the effect on company's net operating income or loss?
- (iii) The management is convinced that a 10% reduction in the selling price,, combined with an increase of Tk. 15,000 in the advertisement cost, will cause unit sales to double. What will the new income statement look like if these changes are adopted?
- (iv) Refer to the original data. The company's advertising agency thinks that a new package would help sales. The proposed new package would increase packing cost Tk. 0.50 per unit. Assuming no other changes, how many units have to be sold to earn a profit of Tk. 5,000.
- (v) Assume the operating results for the year were as follows:

Sales (18,000 units @ Tk. 20 per unit)	Tk. 248,000
Less: Variable cost of sales	162,000
Contribution margin	198,000
Less: Fixed cost for the period	180,000
Network operating loss	<u>Tk. (18,000)</u>

- What will be the degree of operating leverage in this situation?
- The management expects sales to increase by 25% next year. By how much should net operating income increase (use degree of operating leverage)?
- Verify your answer by preparing income statement.

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8. (a) What is the purpose of cost allocation?

(3 <sup>1</sup>/<sub>3</sub>)

(b) Quality Consulting Company provides management consulting services to government and corporate clients. It has two support departments\* – Finance (FIN) and Information Technology (IT) and two operating department\*\* – Government Consulting (GOVT) and Corporate Consulting (CORP). For the year 2021, the following information was available:

(20)

	Support Department		Operating Department		Total
	FIN	IT	GOVT	CORP	
Budgeted overhead before cost allocation (Tk.)	60,000	24,000	80,000	120,000	284,000
Support work by FIN	--	25%	40%	35%	100%
Support work by IT	10%	--	30%	60%	100%

**Required:**

Allocate two support department costs to the two operating departments by using

(i) Direct cost allocation method

(ii) Reciprocal service method

\* Support department is equivalent to service department

\*\* Operating department is equivalent to production department

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**SECTION – A**

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

Assume any reasonable value where necessary.

1. (a) Draw a schematic diagram of a hydrologic cycle. Identify the storage and transport components. Also, write a water budget equation applicable for Ocean. **(8+4+3=15)**
- (b) Purbachal is a developing urban catchment in the fringe of Dhaka city with an area of 2530 ha. It received a rainfall of 11.5 cm in 90 minutes due to a storm. At the outlet of the catchment, the stream draining the catchment was dry before the storm and experienced a runoff lasting for 10 hours with an average discharge value of 49.8 m<sup>3</sup>/s. The stream was again dry after the runoff event. (i) What is the amount of water which was not available to runoff due to combined effect of infiltration, evaporation and transpiration? (ii) What is the runoff coefficient? **(5+2=7)**
- (c) Explain the term "Cloud seeding". For a drainage basin, isohyets drawn for a storm gave the following data. Estimate the average rainfall using Isohyetal method. **(3+10=13)**

Isohyets (interval) (cm)	30-25	25-20	20-15	15-10	10-5
Inter-Isohyetal area (km <sup>2</sup> )	30	22	50	35	25

2. (a) What are the common causes for inconsistency of rainfall record? How do you test such inconsistency of record? **(4+6=10)**
- (b) A 500 ha urban catchment has 50 m elevation difference between the most remote point of the catchment and outlet. Water travels a maximum length of 4000 m and the catchment has following land use classification: **(15)**

Land use	Area (% of total area)	Runoff coefficient, C
Roads	15%	0.70
Lawn	20%	0.15
Residential area	40%	0.35
Industrial area	25%	0.80

Estimated the 100-year peak runoff from the watershed that can be expected at the outlet of the watershed. The intensity-duration-frequency (IDF) relationship for the catchment is given by,

= 2 =

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**Contd... Q. No. 2(b)**

$$i = \frac{6.311T^{0.1523}}{(D + 0.50)^{0.945}}$$

(c) Kaptai Lake is the largest lake in Bangladesh with an approximate surface area of 688 km<sup>2</sup>. In the month of August 2022, the following data were measured: (10)

Mean monthly temperature: 27°C

Mean Relative humidity: 65%

Wind velocity at 1.0 m above the ground: 20 km/h

Estimate the average daily evaporation from Kaptai lake and the volume of water evaporated from the lake during the month of August, 2022.

3. (a) Discuss briefly the effect of basin size and drainage density of flood hydrograph. (4+4=8)

(b) What are the methods available to measure streamflow? Figure-2 shows a typical cross section of a River. Current meter readings, taken at 0.6 depth which is considered as mean velocity of that vertical, have been shown in Table 1. The rating equation of the current meter is given by  $v = 0.35 * n + 0.0029$ , where n is the number of revolutions per second. Calculate the discharge of the river using Area Velocity Method. (4+10=14)

Table 1: current meter readings

Distance form left bank, (m)	7.5	12.5	17.5	22	26	30.5
No of revolutions, N	41	85	118	102	75	50
Observation time, t (sec)	100	100	100	100	100	100

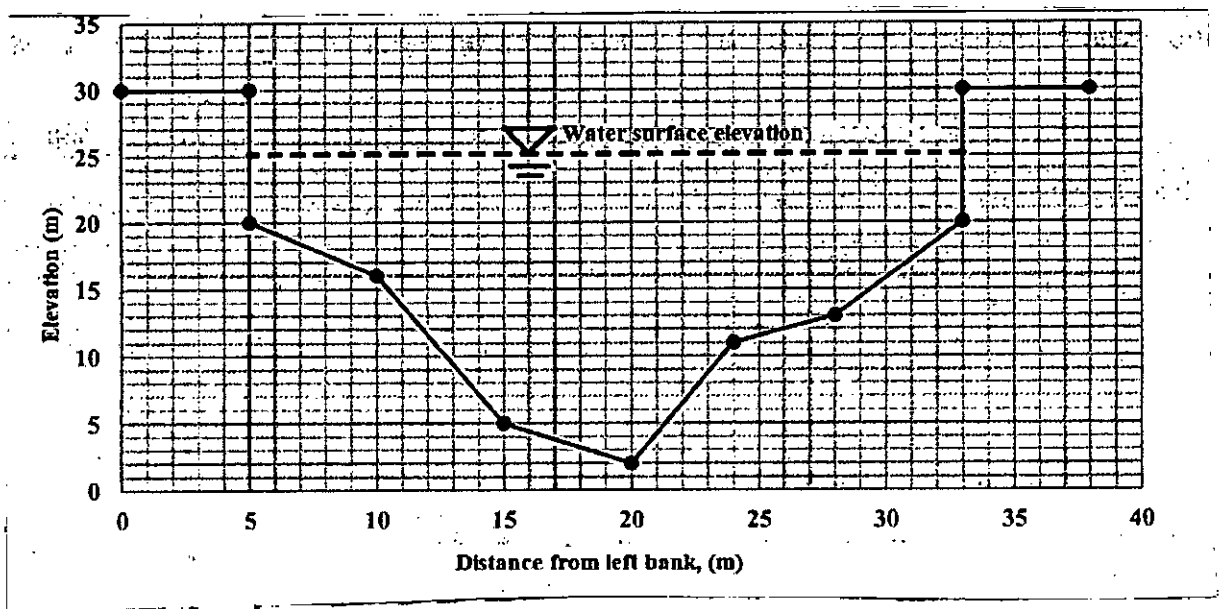


Figure 2: For Question 3(b)

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**Contd... Q. No. 3**

(c) Ordinates of a 8-h unit hydrograph are given. Derive the ordinates of 4-h unit hydrograph for the same catchment. (13)

Time (h)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
Ordinates (m <sup>3</sup> /s)	0	20	35	60	85	120	150	130	105	90	65	40	25	15	0

4. (a) Write short notes on (i) I-D-F relationship (ii) Rating curve (iii) Rainwater harvesting (12)

(b) We know that Dhaka is one of the most densely populated urban area in the world. Currently, RAJUK is developing a large-sale township project named as the Purbachal New Town in the peripheral area of Dhaka city to accommodate its ever-increasing population. What will be the effects of such urbanization on storm water drainage? (10)

(c) A well penetrates a confined aquifer. Prior to pumping, the water level is 30 m. After pumping, at a constant rate of 0.055 m<sup>3</sup>/s for a long period, the drawdown at a distance 60 m and 180 m are 3.1 m and 1.22m, respectively. Compute the hydraulic conductivity and transmissivity. (13)

**SECTION – B**

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

5. (a) What are the general steps of planning a water resources project? Explain each step briefly. (10)

(b) What is EIA? Sketch a flowchart of EIA showing each component. (10)

(c) Name one multi-purpose water resources project of Bangladesh. What are the advantages and disadvantages, that a planner may face in a multipurpose water resources project compared to a single-purpose one? (15)

6. (a) What is Alluvial River and how are they formed? Differentiate between the salient features of Meandering rivers and Braided rivers with an example of each type of river. (12)

(b) What are the various types of rivers based on variation of discharge? Discuss with necessary sketches of hydrographs. (10)

(c) Identify the factors that influence the damages caused by a flood event. Briefly describe what steps can be taken to minimize losses due to floods in Bangladesh. (13)

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7. (a) Draw a general layout of an irrigation canal network. (7)
- (b) What are the special site conditions required for sub-surface irrigation? Differentiate between the sub-surface irrigation and trickle irrigation methods. (11)
- (c) A certain crop can hold 4.8 cm of water in its root zone. Water is allowed to deplete to 60% of its capacity, before irrigation is required in the field having an area of 40 ha. If the consumptive use rate is 6 mm/day, then how frequently does the field need irrigating? Also determine the volume of water that needs to be diverted at canal head regulator if conveyance efficiency is 60%, and application efficiency in half of the field is 50% and in the other half it is 70%. (17)
8. (a) Differentiate between Mechanical dredging and Hydraulic dredging. (6)
- (b) Why has Inland Water Transportation condition in Bangladesh has declined in recent years? Describe briefly. (7)
- (c) Discuss how different alignment of groynes can influence the flow direction and sedimentation in rivers with necessary sketches. (10)
- (d) Draw a qualitative diagram of 'Lock and Dam' method of Navigation. (12)
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**SECTION - A**

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

1. (a) Define Force and its characteristics with an example. (9)
- (b) Define point force, linear force and surface force with example. (6)
- (c) Calculate the magnitude and direction of the resultant of the force system shown in Figure 1. Show the magnitude and direction of the resultant in a diagram. (20)

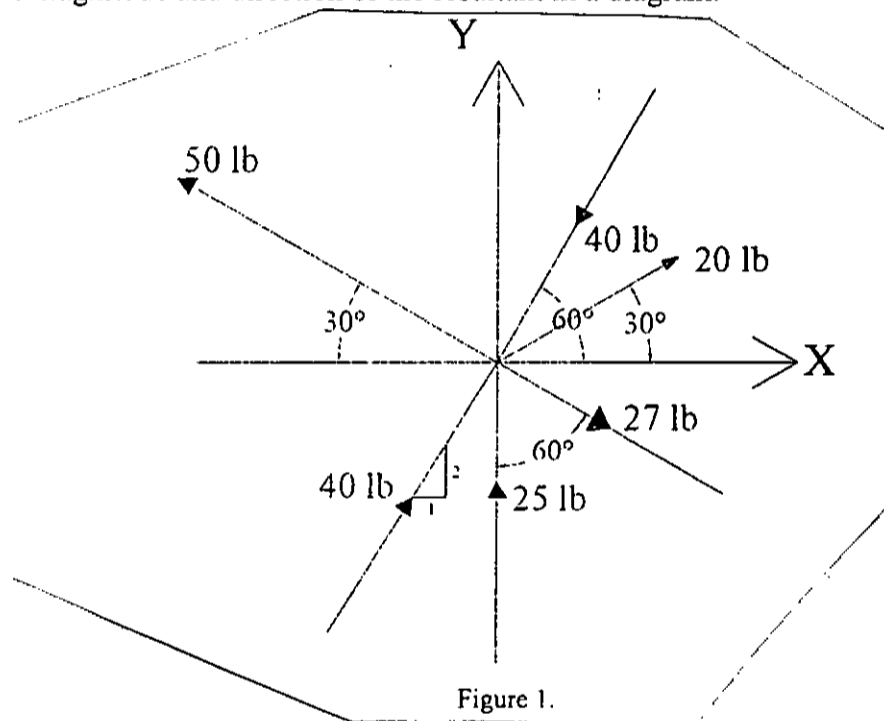


Figure 1.

2. (a) Show different types of support conditions and their reaction forces with figure. (10)
- (b) Wedge A (weight 50 kg) supporting a downward load of 400 N is pressed between two block B (weight 30 kg) and C (weight 40 kg) as shown in Figure 2. The angle formed at the apex of the wedge is 20°. What is the amount of force P required to resist the downward motion of wedge A. Find also the reactions from the planes and contact surfaces (contact surface between the wedges and block, contact surfaces of the blocks with horizontal and vertical plane). All the surfaces are smooth. (25)

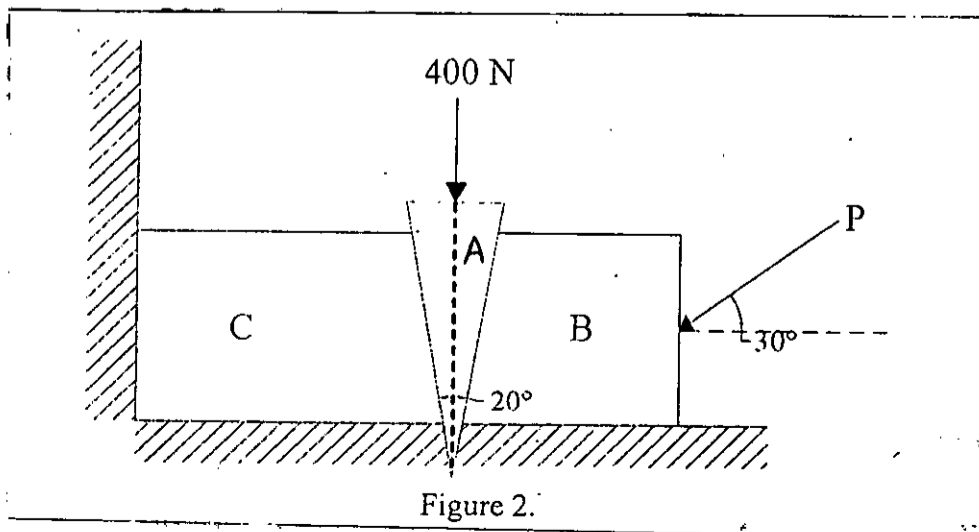
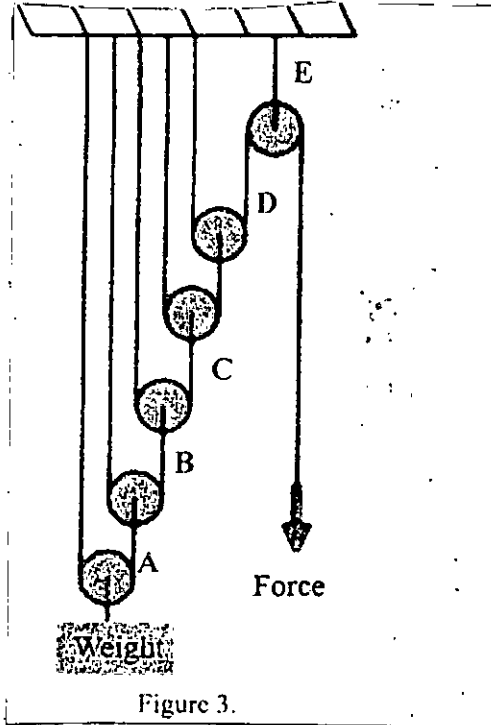


Figure 2.

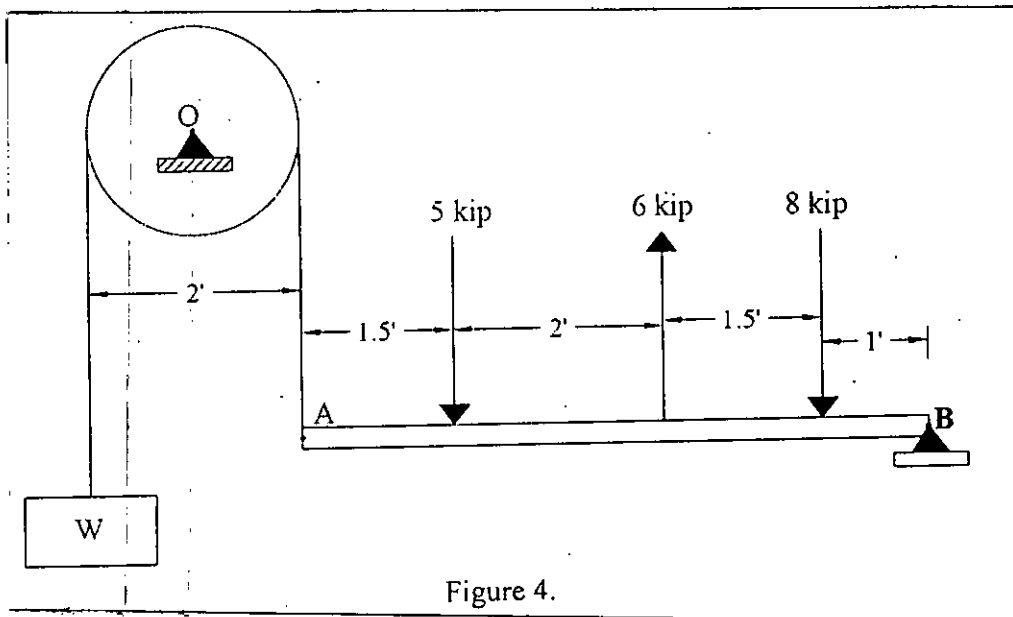
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3. (a) Define moment along with its characteristics. (10)

(b) If the weight attached is of 400 kg what will be the magnitude of 'Force' required to keep the system in equilibrium as shown in Figure 3. Also calculate the magnitude of tension force in rope A, B, C, D, E. (10)



(c) The entire system consists of a link AB and pulley placed at O. Determine the weight 'W' and reaction at 'B' and 'O' if the link AB is in equilibrium in Figure 4. Assume no friction at the pulley and the weight of the 6' long bar is 3 kips. (15)



4. (a) Explain the following terms with figure: (15)

- (i) Coplanar concurrent force system
- (ii) Non-coplanar concurrent forces
- (iii) Equilibrium forces
- (iv) Equilibrant
- (v) Two force member

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**Contd ... Q. No. 4**

(b) Locate the centroid of the composite section shown in Figure 5.

(20)

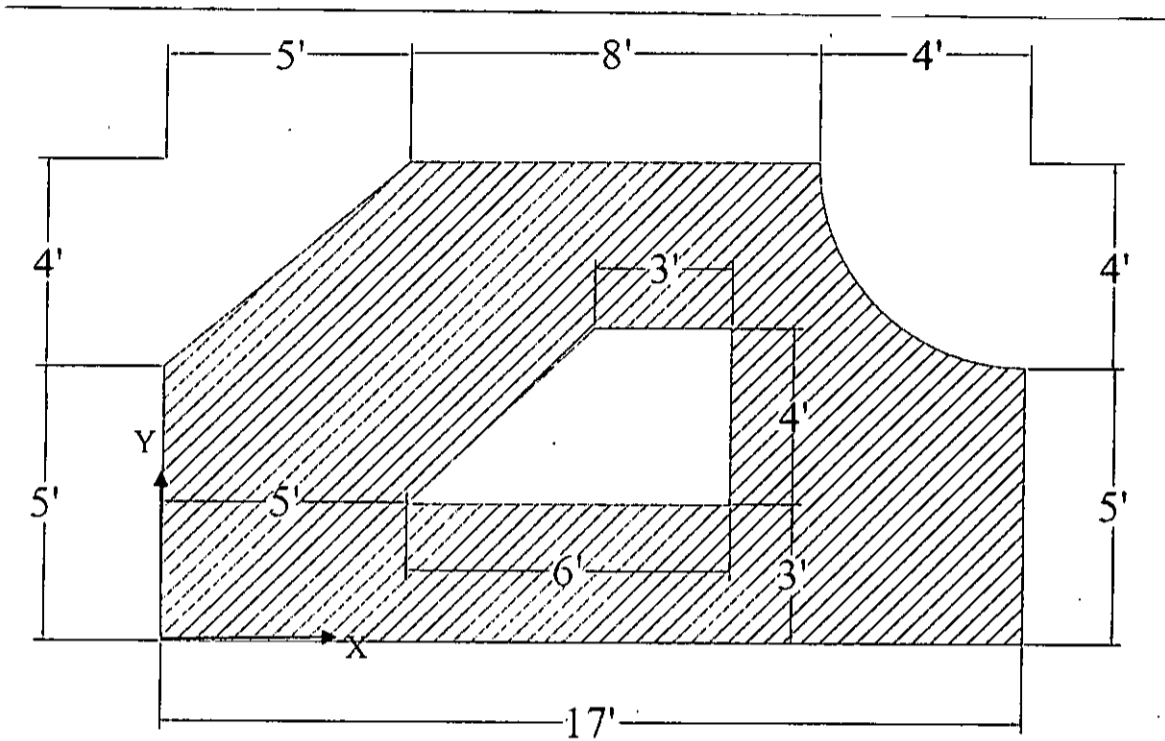


Figure 5.

**SECTION – B**

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

- 5. (a) Define shear force and bending moment with their sign convention. (7)
- (b) ABC is an overhanging beam shown in Figure 6. Draw shear force diagram and bending moment diagram of this beam for the given loading condition. (28)
  
- 6. (a) A solid bar of 35 mm in diameter and 2500 mm long consists of a steel and an aluminum part fastened together, as shown in Figure 7. When axial force P is applied to the system, a strain gage attached to the aluminum indicates an axial strain of 873  $\mu\text{m}/\text{m}$ .
  - (i) Determine the magnitude of applied force P. (12)
  - (ii) If the system behaves elastically, find the total elongation of the bar. Let,  $E_{\text{st}} = 200 \text{ GPa}$  and  $E_{\text{Al}} = 70 \text{ GPa}$ . (11)
- (b) Find the reaction at support of the beam shown in the Figure 8 due to the given loading conditions. (12)

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7. (a) A bar of variable cross section held on the left, is subjected to three forces.  $P_1 = 6 \text{ kN}$ ,  $P_2 = -2 \text{ kN}$ ,  $P_3 = 4 \text{ kN}$ , as shown in Figure 9. Find the maximum axial stress if  $A_1 = 200 \text{ mm}^2$ ,  $A_2 = 100 \text{ mm}^2$ ,  $A_3 = 150 \text{ mm}^2$ . (12)
- (b) Locate the centroid of the composite section shown in Figure 10. (15)
- (c) Define moment of inertia and state the parallel axis theorem. (8)
8. (a) A bar is axially loaded as shown in Figure 11. Determine the normal stress and shear stress on the plane AB shown in the figure. (8)
- (b) The concrete pier shown in the Figure 12 is loaded at the top with a uniformly distributed load of  $15 \text{ kN/m}^2$ . Determine the stress at a level  $0.5 \text{ m}$  above the base. Concrete weighs approximately  $25 \text{ kN/m}^2$ . (14)
- (c) Determine the moment of inertia of area with respect to X and Y axes for the figure shown in Figure 13. (13)

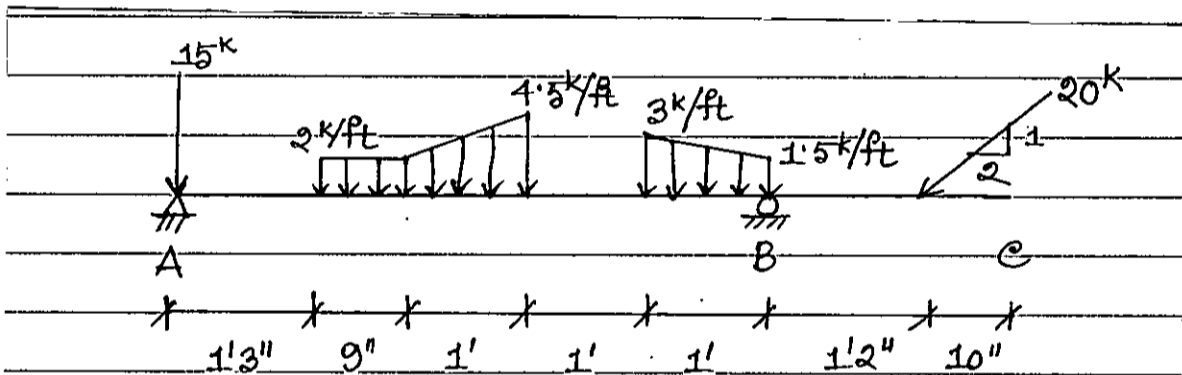


Figure: 6 (for Question 5(b))

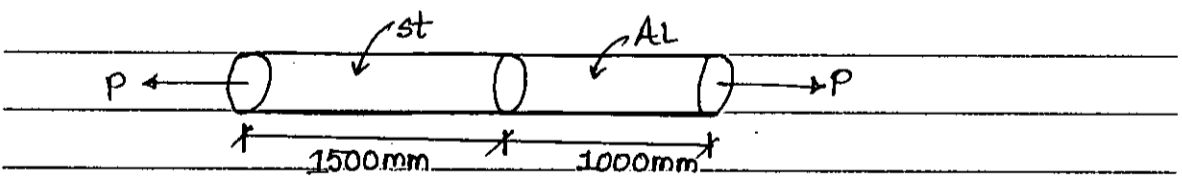


Figure: 7 (for Question 6(a))

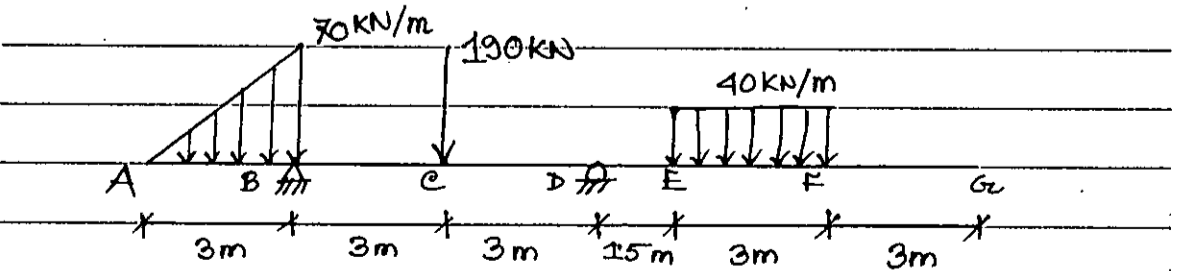


Figure: 8 (for Question 6(b))

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