3-2

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG 301
Time: Two hours | Credit Hour: Two | Full Marks: 50

(Answer any five of the following questions.)

1. Describe formal and informal organization. 10
2. (a) Explain Grapevine 5
   (b) Write about managerial skills. 5
3. Analyze span of management with their advantages and disadvantages. 10
4. Explain the bases of power and empowerment policy with examples. 10
5. Write about organization culture. 10
6. Evaluate equity theory of motivation. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering II | Course Code: CE 313
Time: 3 hours | Credit Hour : 3.0 | Full Marks: 100

ANSWER ALL QUESTIONS. Assume any missing data reasonably.
(Roll=Last two digits of your registration number)

PART-A

1. Analyze the frame (shown in ***Fig.1***) to determine the horizontal deflection at **D** by the Virtual Work Method [P= 68-kip, L= 28 ft for Even Rolls or P= 47-kip, L= 37 ft for Odd Rolls and EI=Constant]. [10]

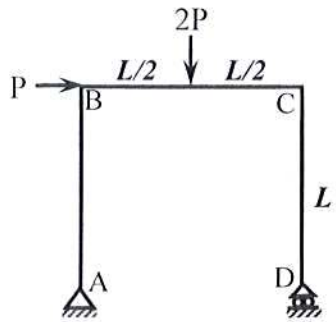


Fig.1

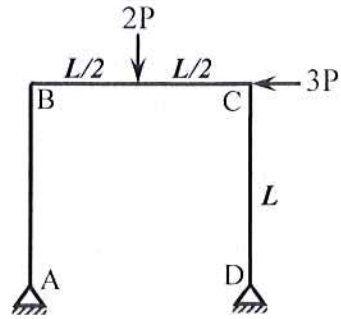


Fig.2

2. Analyze the frame in ***Fig.2*** by Force Method and determine the support reactions. Consider the horizontal reaction at *A* as redundant [P= 68-kips, L= 28 ft for Even Rolls or P= 47-kips, L= 37 ft for Odd Rolls and EI=Constant]. [16]

3. Analyze the Beam in ***Fig.3*** by Force Method and determine the reactions. Consider the reaction at *Q* as the redundant [P= 68-kips for Even Rolls or P= 47-kips for Odd Rolls and EI=Constant]. [14]

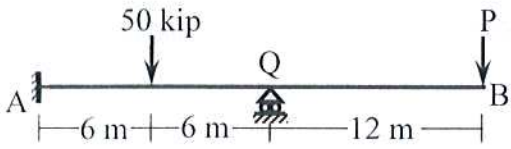


Fig.3

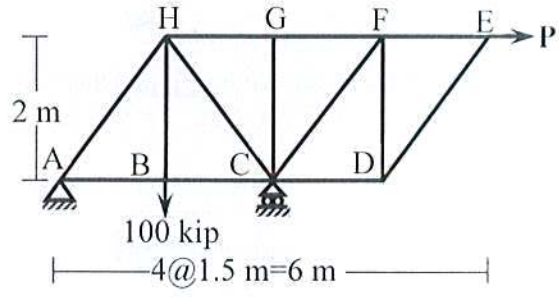


Fig.4

4. Analyze the truss to determine the horizontal deflection of joint **E** as shown in ***Fig.4*** by the Virtual Work Load Method [P= 68-kip for Even Rolls or P= 47-kip for Odd Rolls and EA=Constant]. [10]

PART-B

5. Analyze the frame shown in shown in ***Fig.5*** by Cantilever Method to draw the axial force and moment diagram of columns. **[10]**

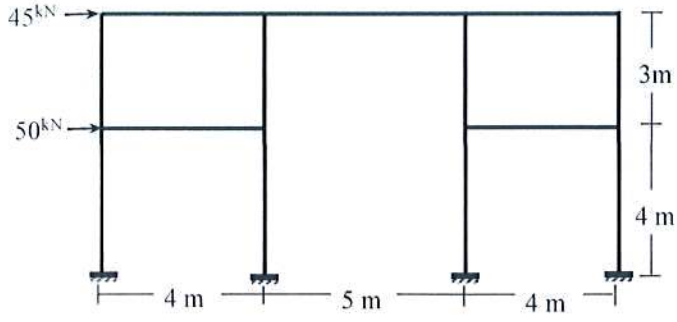


Fig.5

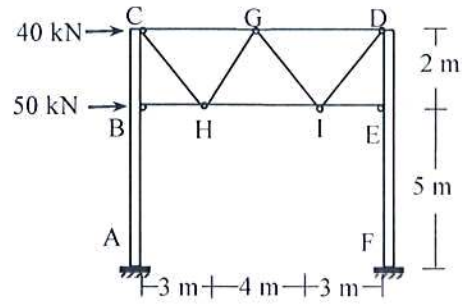


Fig.6

6. Analyze the mill bent shown in ***Fig.6*** by Portal Method to determine the reactions at support **A** and **F**. Also, determine the force in members **GD** and **CH**. **[05]**

7. (i) Draw the qualitative influence lines of the beam shown in ***Fig.7***, **[05]**
   (a) Bending moments M_B, M_G
   (b) Support reactions R_E, R_D and
   (c) Shear forces $V_B^{(L)}$, $V_C^{(L)}$

   (ii) Analyze the beam to calculate the maximum value of R_D , if the beam ***(Fig.7)*** is subjected to a uniformly distributed dead load of 25 kN/m, moving live load of 20 kN/m and 50 kN concentrated load [Given: EI = constant]. **[10]**

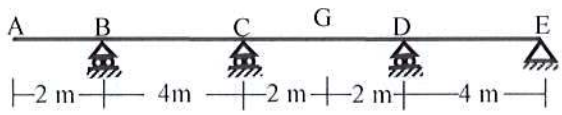


Fig.7

8. Analyze the frame shown in ***Fig.8*** using Moment Distribution Method to draw bending moment diagram [Given: E = 220 GPa , I = 95×10^6 mm^4]. **[15]**

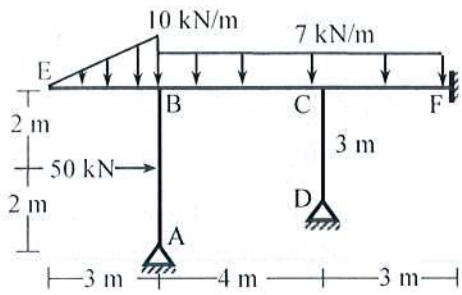


Fig.8

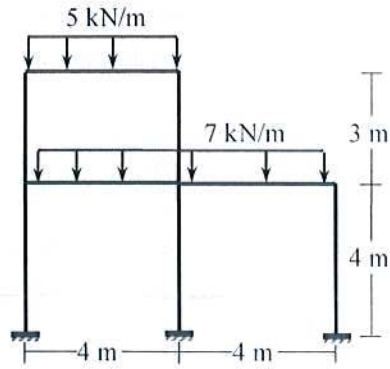


Fig.9

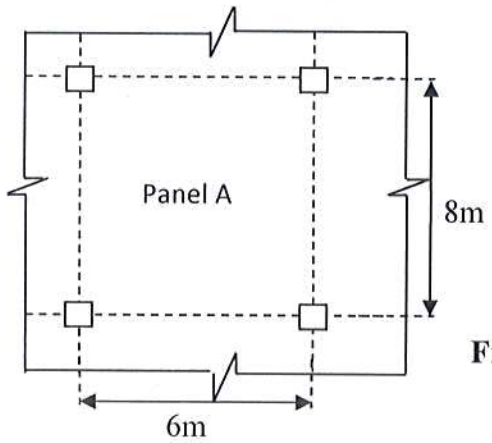
9. Analyze the frame is shown in ***Fig.9*** to obtain bending moment (with diagram) using Vertical Load (Approximate) Method of the frame. **[05]**

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B.Sc. in Civil Engineering

Course Title: Design of Concrete Structures II — Course Code: CE 317
Time: 3 hours — Credit Hour: 3.00 — Full Marks: 100

QUESTION 1 [20 MARKS]

a. The interior slab panel of an office building (live load 2.4 kN/m^2) is shown in **Figure 1**. The floor will be constructed with flat slab and it carries 3 kN/m^2 dead load due to random wall and floor finishes. Thickness of the slab could be assumed as 240 mm. **Apply** the concept to design the **short span column strip** of the slab for moment only. Assume required data for design, concrete strength (f_c') could be used as 24 N/mm^2. [10 Marks]



Moment	Moment coefficient
Support Negative Moment	0.65
Mid span positive moment	0.35

Figure 1. Panel of flat slab

b. A post-tensioned prestress girder of elevated express way is simply supported with 15 m span. The girder is subjected to uniformly distributed 30 kN/m dead load (including self-weight) and 20 kN/m live load. The available concrete having the maximum allowable compressive stress for the construction is 40 N/mm^2. **Propose a suitable size of the girder and maximum eccentricity of curved tendon** for full prestressing condition (top compressive stress should be within allowable stress of the concrete and bottom tensile stress should be zero), **justify** the proposal through stress analysis of the girder. The width of the rectangular section of the girder could be assumed as 300 mm. [10 Marks]

QUESTION 2 [20 MARKS]

a. A column of a multi-storeyed academic building is subjected to dead and live loads of 2500 kN and 800 kN, respectively. **Apply** design concept to obtain the **size and reinforcement** of the column as **tie and spiral** columns. [10 Marks]

b. The above-mentioned column is supported by isolated pad footing, the bearing capacity of the soil under the footing is 190 kN/m^2. The depth of the footing could be assumed as 800 mm. Apply the concept to design the footing with checking of punching shear. Assume required data to design the footing. [10 Marks]

QUESTION 3[20 MARKS]

The floor layout plan of a 10-storeyed student hostel (live load 2 kN/m^2) is shown in **Figure 2**. The floor of the structure will be supported by beam and it carries 2.5 kN/m^2 dead load due to random wall and floor finishes. The size of the beam could be assumed as 300 mm x 750 mm. The secondary beam is located at centre of the main beam. Design the **slab panel "S1" (short span only)** as shown in **Figure 2**. Synthesis (optimize) the thickness of the slab considering deflection and shear requirements of ACI / BNBC code. Assume required data to design the slab. The shear coefficient of the slab is 0.5, the bending moment coefficient of slab is shown in the attached file. [20 Marks]

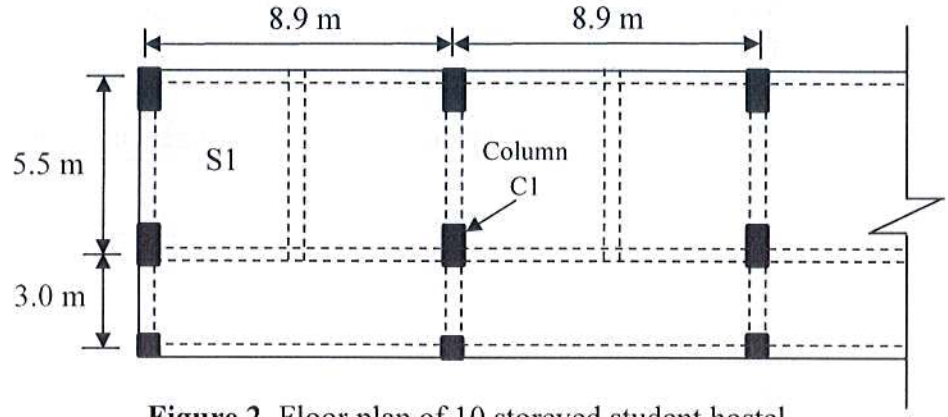


Figure 2. Floor plan of 10 storeyed student hostel

QUESTION 4 [20 MARKS]

The column **"C1"** as shown in **Figure 2** of the building structure stated in **Question 3** is required to be designed as rectangular tie column. The uni-axial design moment of the column at ground floor could be considered as 500 kN-m, use approximate method to obtain design load of the column. The column has to be designed for the lowest minimal dimension considering all possible options of BNBC 2020. **Propose** a solution to **design** the ground floor column with structural details. The column design chart as shown in **Appendix** could be used to design the column. [20 Marks]

QUESTION 5 [20 MARKS]

The column **"C1"** as shown in **Figure 2** of the building structure stated in **Question 3** is supported by **pile foundation**. The capacity of 600 mm diameter bore pile could be considered with the maximum value of 1000 kN. Thickness of the pile cap is required to be minimal in design considering all possible options (number of piles, dimension of column, flexural and punching shear) in accordance to BNBC 2020 / ACI 318. **Propose** a solution to **design the pile cap** with the **minimum thickness**. Assume required data to design the pile cap. [20 Marks]

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course Code: CE 333
Time: 3.00 Hours | Credit Hour: 3.00 | Full Marks: 120

There are five (5) questions. Answer all the questions. Assume any missing data. All questions bear equal marks [5×24=120]

1. (a) Explain the operational mechanisms of onsite, offsite, wet, and dry sanitation systems used in rural and urban areas. **[8]**

   (b) Design rectangular sedimentation tanks employing the following dataset and formula: **[16]**

   - Average flow rate, Qav=40,000 m^3/d.
   - Peak hourly flow rate, Qp=80,000 m^3/d.
   - Specific gravity of the particles to be removed, s=1.25.
   - Diameter of the particles, d=100 μm.
   - Darcy-Weisbach fraction factor, f=0.025.
   - Scouring material constant, k=0.05.

   Formula: $V_H = \left[\frac{8k(s-1)gd}{f}\right]^{1/2}$ $R = \frac{t}{a+bt}$

2. (a) Describe the bacterial growth phases observed in wastewater treatment plants. **[8]**

   (b) Explain the pure oxygen and extended aeration activated sludge processes. **[16]**

3. Estimate the volume of the aeration tank of high purity oxygen activated sludge system for municipal wastewater treatment employing the following data set, and check with design parameters. Also, find out the expected effluent BOD_5 concentration of the system. **[24]**

Parameter	Value
Design avaerage flow, Q	3500 m^3/d
Influent BOD	300 mg/L
Influent TSS	200 mg/L
F/M	0.6 lb BOD applied/lb MLVSS.d
MLSS	7500 mg/L
VSS/TSS	0.8
Maximum volumetric BOD load	4 kg/(m^3.d)
Minimum aeration time	2h
Minimum cell residence time	4d
K_S	60 mg/L of BOD
k_d	0.06/d
Y	0.6VSS/mg BOD
k	6d^{-1}

Formula:

$$F/M = \frac{S_0}{\theta X} = \frac{QS_0}{VX} \qquad \theta_c = \frac{VX}{QX_i} \qquad S = \frac{K_s(1+\theta_c k_d)}{\theta_c(Yk - k_d) - 1}$$

4. (a) With a flow diagram show the nitrification, denitrification processes that contribute to nitrogen removal in wastewater treatment plants and the factors that influence these removal pathways. [12]

   (b) Explain the operational mechanisms of (i) Three sludge systems for nitrogen removal; and (ii) Pre-precipitation for phosphorus removal. [12]

5. As an environmental engineer, you have been assigned to polish a polluted lake. The water quality parameters of the polluted lake are provided in the following table. Answer the following questions: (i) what type of natural technologies will you select to treat the polluted lake? and (ii) with a schematic diagram show how the pollutants will be removed with the designed natural wastewater treatment technologies? [24]

	Unit	Concentration
pH		6.1
DO	mg/L	0.4
NH_4-N		20
NO_3-N		50
TN		90
BOD_5		400
COD		1000
TSS		1200
TP		10

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall – 2022
Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering I | Course Code: CE 351
Time: 3 hours | Credit Hour: 03 | Full Marks: 150

There are Five Questions. Answer All the Questions

[Assume reasonable data if any]

1. a) State the objectives of Parking studies. Summarize the areas where parking should be prohibited. Compare between Parallel parking and Angular parking. **[4+4+7]**

   b) Describe briefly different kind of bike facilities that can be incorporated in a road segment. **[9]**

   c) A new building in front of UAP is expected to add 2000 pedestrians to a 24-ft sidewalk during the peak 15 min period. The sidewalk already has a flow of 1800 pedestrians during peak period. Characterize the quality of flow. **[6]**

2 a) An urban secondary street with 35 ft pavement width having a reflectance of 12% carries a maximum of 1050 vph at night time. Sketch the lighting system considering fluorescent source with a mounting height of 35 ft and a maintenance factor of 0.88. **[12]**

   b) Two straight sections of a highway meet at an angle of 170°. If the radius of a simple circular curve is 600 m, calculate
   i. Long chord
   ii. Apex distance
   iii. Tangent distance
   iv. Mid-Ordinate **[12]**

   c) Sketch the cross-section of roadway right of way (R.O.W) **[6]**

3 a) Calculate the inter zonal trips using a simple gravity model from the following data. Assume exponent of travel time as 0.6

Production Zone i	Employment Zone	Employments	Travel time from Zone i
T_i = 450 work trips	1	750	9 minutes
	2	400	5 minutes
	3	300	7 minutes

[12]

   b) Determine the minimum passing sight distance for a two-lane, two-way highway for the following conditions:
   Average speed of the passing vehicle = 61 mph
   Average speed of the passed vehicle = 46 mph
   Time of preliminary delay for passing vehicle = 5 sec
   Average acceleration rate for passing vehicle = 2.43 mph/s
   Time passing vehicle occupied the opposite lane = 15 sec
   Safe clearance distance = 180 ft. **[12]**

   c) Explain briefly about Intersection Sight Distance. **[6]**

4. a) A sag vertical curve is to be designed to join a 6% grade to a 3% grade. If the design speed is 60 mi/h, determine the minimum length of the curve that will satisfy all criteria. Assume a = 11.2 ft /sec^2 and perception-reaction time is 2.5 sec. [15]

b) A bus system needs to be set up between the University of Dhaka and The University of Asia Pacific, a distance of 10 mile. The operating time is 30 min. It has been estimated that the peak-hour demand is 600 passenger/hour and 50-seater buses are available, which can safely accommodate 25 standees. Determine the fleet size and design the basic system, assuming that the policy headway is 30 min and that the minimum terminal time is 7.5 min, which may be revised if necessary. [15]

5 a) A student trying to test the braking ability of her car determined that she needed 25 ft more to stop her car when driving downhill on a road segment of 7% grade than when driving downhill at the same speed along another segment of 4% grade. Determine the speed at which the student conducted her test and the braking distance on the 7% grade if the student is traveling at the test speed in the uphill direction. [12]

b) A horizontal curve with a radius of 900 ft is designed for a two-lane highway having a design speed of 70 mph. The section of highway is having a 5% upgrade. Driver's reaction time is 2.5 sec, the AASHTO standard for highway braking reaction. Calculate the closest distance for any roadside object may be placed to the centerline of the inside lane of the roadway? [12]

c) Discuss briefly about Bus Rapid Transit. [6]

Formula:

$$T_{ij} = \frac{A_j F_{t_{ij}} K_{ij}}{\sum A_j F_{t_{ij}} K_{ij}} X P_i \qquad F_{t_{ij}} = \frac{c}{t^n}$$

$$S < L: \quad L = \frac{AS^2}{100(\sqrt{2h_1} + \sqrt{2h_2})^2}$$

$$S > L: \quad L = 2S - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A}$$

$$S < L: \quad L = \frac{AS^2}{200[2.0 + S(\tan 1^\circ)]}$$

$$S > L: \quad L = 2S - \frac{200[2.0 + S(\tan 1^\circ)]}{A}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Hydrology | Credit Hour: 3.0 | Course Code: CE 363
Time: 3 hours | Full Marks: 100

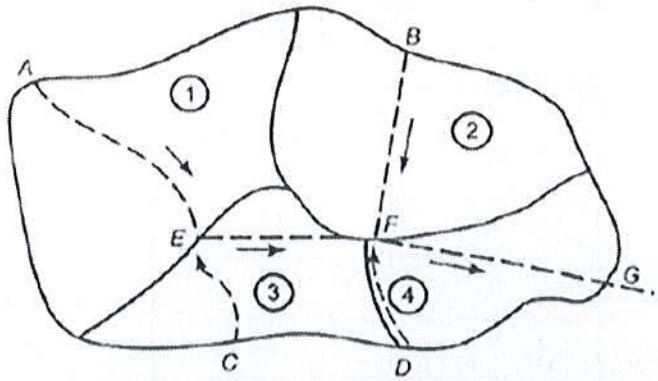
Answer all the questions (10+20+20+25+25). The numbers inside the brackets indicate marks.

1 (a) State the applications of rational method. (5)
(b) Define aquifer, aquitard, and aquiclude. (5)

2 a) Briefly discuss the deterministic and stochastic approaches used in hydrology. Also discuss the application of probability in hydrology. (10)
b) Discuss the factors considered in determining the rainfall intensity using rational method. (10)

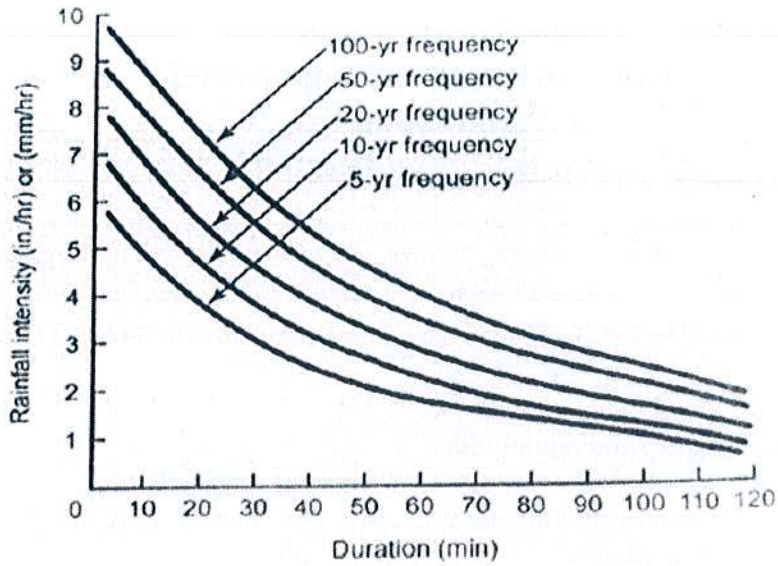
3 (a) An urban watershed is shown along with the travel paths from the most remote points in each subarea. The details of the subareas are given in the accompanied Table. Determine the 20-yr peak flow at the drainage outlet G by using the provided IDF (Intensity-Duration-Frequency) curve and Kirpich formula. (15)

Kirpich formula for determining overland time is, $t_i = \frac{0.0077L^{0.77}}{S^{0.375}}$



Area	Area (Acres)	C
1	20	0.30
2	15	0.35
3	12	0.40
4	10	0.45

Path	Length (ft)	Slope (%)
AE	1800	2.6
BF	1700	2.8
CE	1500	3.1
DF	1200	1.7
EF	1300	1.9
FG	1900	2.1



(b) Determine 6 hr unit hydrograph from 2 hr unit hydrograph by lagging method. (5)

Time (Hour)	Total Flow (m^3/s)
0	0
1	6
2	10
3	20
4	25
5	35
6	22
7	17
8	12
9	5
10	0

4 (a) A channel runs almost parallel to a river. The elevations of the water level in the river and in the channel are 180 ft and 130 ft, respectively. The river and the channel are 4000 ft apart. A pervious formation of confined aquifer with an average of 50 ft thickness and hydraulic conductivity of 0.35 ft/hr joins them together. Determine the rate of seepage flow from the river to the channel. (5)

(b) Find the first five values of outflow using level pool methodology. Area of the reservoir is 1 acre. (20)

Time (min)	Inflow (cfs)
0	0
10	50
20	100
30	180
40	220
50	300
60	340
70	370
80	360
90	340
100	300
110	220
120	160
130	100
140	70
150	40
160	20
170	0
180	0
190	0
200	0

Elevation (ft)	Discharge (cfs)
0	0
0.5	5
1	9
1.5	18
2	35
2.5	50
3	65
3.5	75
4	95
4.5	120
5	140
5.5	165
6	185
6.5	205
7	215
7.5	230
8	245
8.5	255
9	265
9.5	270
10	275

5 Assume the annual maximum flood measured at a local valley given in the table below follows lognormal distribution.

No.	Max. Flood (cfs)	No.	Max. Flood (cfs)
1	4100	11	4300
2	2500	12	3700
3	5200	13	3300
4	4500	14	4000
5	3800	15	3300
6	3000	16	7200
7	2500	17	5200
8	2200	18	1000
9	3200	19	650
10	2400		

a) Using frequency curve and the mathematical equation estimate the 20-year annual maximum flood and the exceedance probability and return period for an event of 3000 cfs. (20)

b) Compare the findings to investigate whether the data follows lognormal distribution or not? Use the frequency factor table given below. (5)

Table: Frequency Factor for Normal Distribution

Exceedance Probability	Return Period	K	Exceedance Probability	Return Period	K
0.0001	10,000	3.719	0.450	2.22	0.126
0.0005	2,000	3.291	0.500	2.00	0.000
0.001	1,000	3.090	0.550	1.82	-0.126
0.002	500	2.88	0.600	1.67	-0.253
0.003	333	2.76	0.650	1.54	-0.385
0.004	250	2.65	0.700	1.43	-0.524
0.005	200	2.576	0.750	1.33	-0.674
0.010	100	2.326	0.800	1.25	-0.842
0.025	40	1.960	0.850	1.18	-1.036
0.050	20	1.645	0.900	1.11	-1.282
0.100	10	1.282	0.950	1.053	-1.645
0.150	6.67	1.036	0.975	1.026	-1.960
0.200	5.00	0.842	0.990	1.010	-2.326
0.250	4.00	0.674	0.995	1.005	-2.576
0.300	3.33	0.524	0.999	1.001	-3.090
0.350	2.86	0.385	0.9995	1.0005	-3.291
0.400	2.50	0.253	0.9999	1.0001	-3.719