B.Sc. Engg. (CEE)/ 3rd Sem. 23 December 2023 (Group B: Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Semester Final Examination **Winter Semester: 2022-2023**
Course No.: GS 4351 **Full Marks: 150**
Course Title: Geology and Geomorphology **Time: 3 hours**

There are **6 (Six)** Questions. **Answer all questions**. Programmable calculators are not allowed. Do not write on this questions paper except when using provided graphs. The symbols have their usual meaning. Assume reasonable values for any missing information. Assigned marks, along with CO-PO for each question, is shown at the right margin.

1(a) Identify the nearby major plate boundaries that influences the seismology of Bangladesh, indicating direction of movements and boundary types. **(6) [CO1 PO1]**

1(b) Discuss i) Fractional crystallization, ii) foliation, and iii) strike and dip. **(9) [CO1 PO1]**

1(c) What do you understand by 'Pacific Ring of Fire'? Explain the formation of eroded profiles of anticline and syncline with sketch. **(6) [CO2 PO1]**

1(d) Distinguish between: i) Felsic and Mafic Magma, ii) P and S- wave, iii) Cross-bedding and Graded beding. **(9) [CO2 PO1]**

2(a) Explain the mechanism of fluvial erosion and the process of natural levee formation at the edge of flood plain, in the context of Bangladesh. **(5+4) [CO3 PO2]**

2(b) A river is carrying significant amount of suspended load of different sizes. During dry season, a section of river flows 31 cubic meter per second through 250 sq. meter cross section. *Find the minimum size of the deposited particles*. However, during moonson, the flow increases significantly but the channel cross section only increases 5 sq. meter for each 50 cubic meter flow increase. *What would be the flow rate (in cubic meter per second) when minimum sized particles, deposited during dry season, will be eroded away?* Use curve shown in Figure 1. **(15) [CO4 PO2]**

3(a) Assume, due to high volume of rainfall, IUT campus is at risk of short-duration flooding. Discuss three potenital solutions of such scenario. Include drawbacks and critical considerations you need to make for each solution. **(9) [CO3 PO2]**

3(b) Grade the stream network covering 5 sq. km area shown in Figure 2 using Horton's method (separate the page from the question and staple to your script). Find bifurcation ratio, length ratio, drainage density, and stream frequency. Length of stream can be estimated using the following formula: $(n+1)^{(0.8+n)}$ km, where 'n' is the stream order. **(15) [CO4 PO2]**

4(a) Identify different types of sediment tranportation with neat sketches. Explain why Richter scale is less-suitable for civil engineering designs. **(5+4)** [CO3 PO2]

4(b) A seismic survey was conducted at a site to measure subsoil condition. Time-distance information obtained through this survey was used to construct the graph shown in Figure 3. Identify layer materials and measure layer thickness using information in Figure 3 and 4. **(15)** [CO4 PO2]

5(a) Develop qualitiative flood hydrographs for the following scenarios: i) urbnization, ii) high intensity short duration rainfall, and iii) drainge basin with high number of drinage channels. Provide comment on each graphs' shape and type. **(9)** [CO3 PO2]

5(b) Two drainage basins (A and B) that drain to the same outlet have the following properties of Unit Hydrograph and rainfall data: **(15)** [CO4 PO2]

	Area	Rainfall intensity	Rainfall start time	Time of Concentration	Discharge for Unit Rainfall
Basin A	2 sq. km	1.5 cm	2:00 PM	42 min	150 cu.m/s
Basin B	3 sq. km	1.2 cm	2:15 PM	35 min	190 cu.m./s

Rainfall is ongoing. What is the magnitude and earliest time of peak discharge?

6(a) What are the assumptions and limitations of rational method of peak runoff flow calculation? **(9)** [CO3 PO2]

6(b) Find earthquake location (using a graph) and magnitude of a given earthquake using the information from seismic stations given below. One of the station has an uncalibrated/inaccurate instrument. Identify the problamatic station along with the concerning instrument and find out what should have been the actual arrival time and ground acceleration of the inaccurate instrument. Richter nomograph is provided in Figure 5. **(15)** [CO4 PO2]

Station	Coordinates (X,Y) of the Station, km	S-P wave diff., sec.	Amplitude, mm
A	0,0	39	10
B	300,400	18	50
C	700,200	48	20
D	500,450	36	9
E	400,700	52	2.5

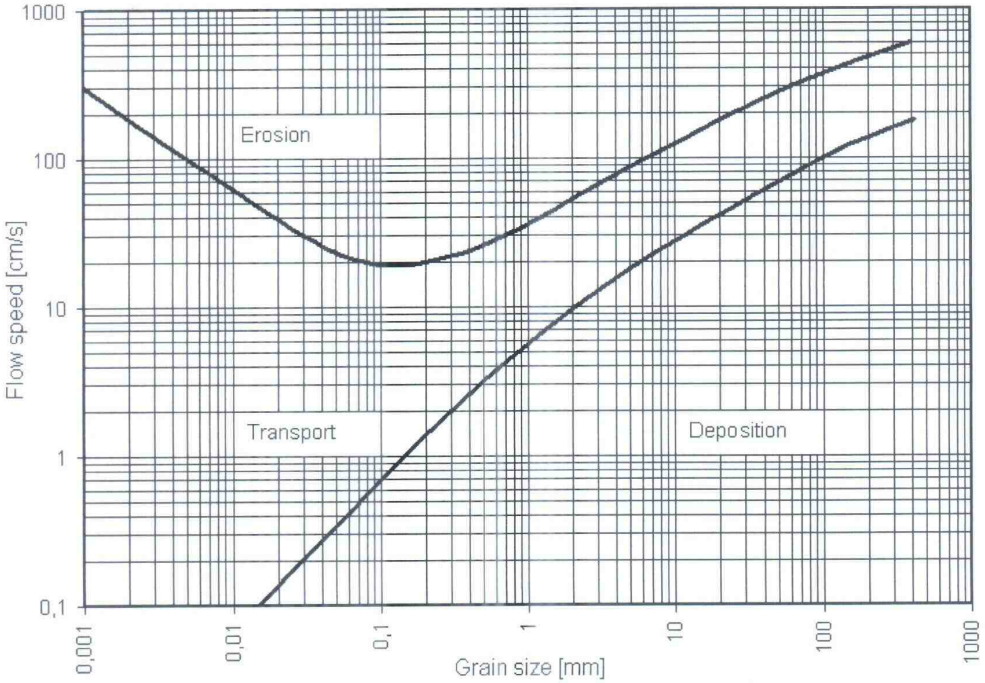

Figure 1

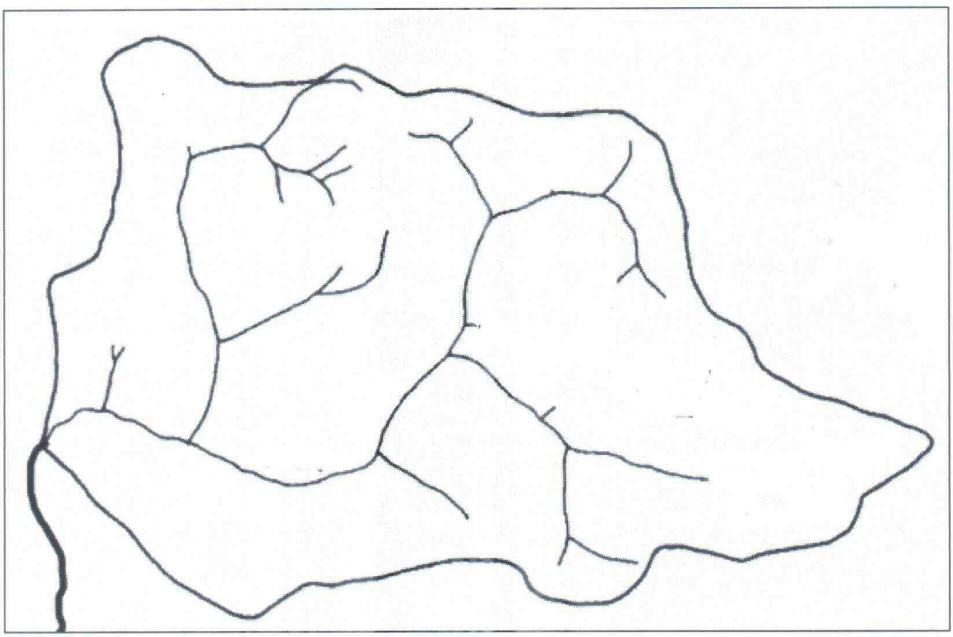

Figure 2

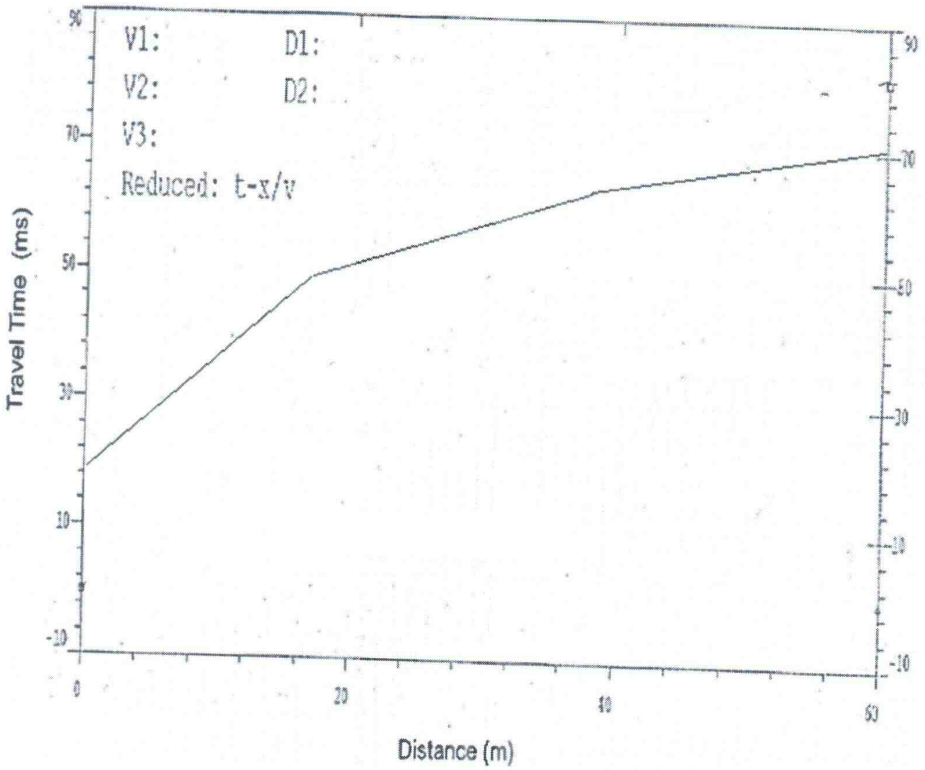

Figure 3

Type of soil or rock	*P*-wave velocity m/s
Soil	
Sand, dry silt, and fine-grained topsoil	200–1000
Alluvium	500–2000
Compacted clays, clayey gravel, and dense clayey sand	1000–2500
Loess	250–750
Rock	
Slate and shale	2500–5000
Sandstone	1500–5000
Granite	4000–6000
Sound limestone	5000–10,000

Figure 4

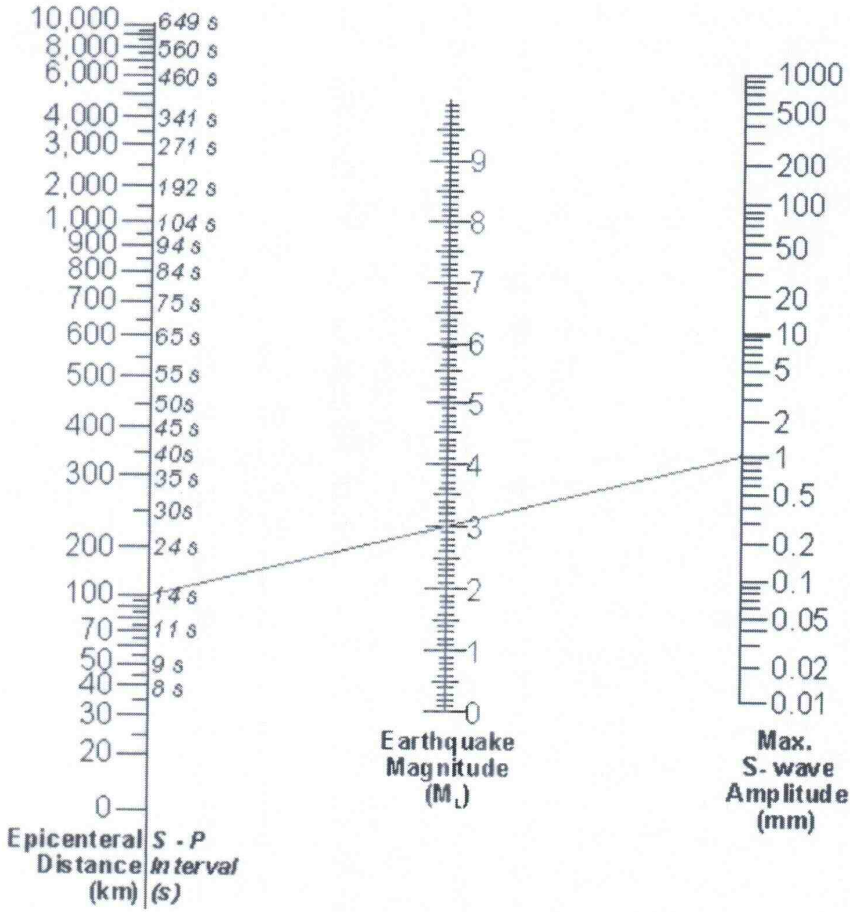
10,000
8,000
6,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
70
50
40
30
20
0
649 s
560 s
460 s
341 s
271 s
192 s
104 s
94 s
84 s
75 s
65 s
55 s
50s
45 s
40s
35 s
30s
24 s
14 s
11 s
9 s
8 s
Epicenteral Distance (km)
S - P Interval (s)
9
8
7
6
5
4
3
2
1
0
Earthquake Magnitude (M_L)
1000
500
200
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
Max. S-wave Amplitude (mm)

Figure 5