University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
4th Year 2nd Semester

Course Title: Environmental Engineering V   Course Code: CE 435
Time: 1 hour   Credit Hour: 2.00   Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]
a. Describe development by considering both its social and economic dimensions. [3]

b. Analyse how poverty influences the pace and quality of development in a country. [7]

QUESTION 2 [10 MARKS]
a. Identify the key components of sustainable development. [3]

b. Explain the biggest challenges civil engineers face in Bangladesh while working towards the SDGs. [7]

QUESTION 3 [10 MARKS]
a. Summarize the studies conducted to assess the impacts of any development project. [3]

b. Discuss the role of civil engineers in addressing the challenges of sustainable infrastructure and urban development in Bangladesh. [7]

QUESTION 4 [10 MARKS]
a. Illustrate the limitations of GDP as an indicator of welfare. [4]

b. Calculate the MPI for a hypothetical region using given indicators. [6]

Indicator	Household		
	1	2	3
Household size	10	6	7
Health			
At least one member is undernourished	1	0	1
One or more children have died	0	0	1

Indicator	Household		
	1	2	3
Education			
No one has completed six years of schooling	0	1	0
At least one school-age child not enrolled in school	1	0	0
Standard of living			
No electricity	1	0	0
No access to improved sanitation	0	1	1
No access to an improved source of drinking water	0	0	1
House built with inadequate materials	0	0	0
Household cooks with dung, wood, charcoal or coal	0	1	1
Household does not own a car or truck and does not own more than one of the following assets: radio, television, computer, animal cart, bicycle, motorbike or refrigerator	0	0	0

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination (Fall 2024)
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering IV Course Code: CE 433
Time: 1 hour Credit Hours: 2.00 Full Marks: 40

(There are <u>SIX</u> questions. You must answer all the questions.)

1. Consider a locality which uses river water as their primary source for drinking and other household activities. Suddenly, a number of diseases e.g., dysentery, skin disease, dengue, malaria etc. started to spread among the local population. [5]

   Investigate the reason behind this situation. Justify your answer by explaining the classifications of diseases associated with water.

2. A 30-mL sample of sewage is mixed with dilution water to fill a BOD bottle. Initial DO is 8.5 mg/L and DO after 10 days is 3.7 mg/L. For a BOD bottle filled with only dilution water, initial DO is 9.1 mg/L and after 10 days DO is 7.8 mg/L. [5]

   i. *Calculate* Total BOD of sewage after 10 days.
   ii. If the TKN value of the sewage is 1.8 mg/L, *calculate* the CBOD and NBOD of the sewage sample.

3. On February 15, 2025, the following air quality data have been recorded at the CAMs in Dhaka. *Calculate* and report AQI for $15 - 02 - 2025$. [10]

   i. $PM_{2.5} = 430$ $\mu g/m^3$ (24-hr)
   ii. $PM_{10} = 240$ $\mu g/m^3$ (24-hr)
   iii. $O_3 = 0.068$ ppm (8-hr)
   iv. $SO_2 = 0.18$ ppm (24-hr)

4. *Explain* the adverse impact of thermal pollution on the dissolved oxygen of water bodies. [5]

5. *Discuss* the water quality management options to control pollution in lakes. [5]

6. A lake with a surface area of 125×10^6 m^2 is fed by a stream having a flow rate of 18 m^3/s with 0.005 mg/L phosphorus. Effluent from a wastewater treatment plant also discharges into the lake. The effluent flow rate is 1.3 m^3/s, and its phosphorus concentration is 15 mg/L In addition, effluent from a point source adds on 0.5 g/s of phosphorus into the lake.

   a) If the phosphorus settling rate is 15 m/yr, *calculate* the average phosphorus concentration in the lake using "Simple Phosphorus Model". [5]

   b) *Estimate* the amount of additional phosphorus removal required at the treatment plant to keep the phosphorus concentration in the lake below 0.010 mg/L. [5]

Table 1: Breakpoint concentrations of criteria pollutants according to U.S. EPA.

			Breakpoints					
O_3 (ppm) 8-hour	O_3 (ppm) 8-hour[1]	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)	AQI	Category
0-0.064	–	0-54	0-15.4	0-4.4	0-0.034	([2])	0-50	Good
0.065-0.084	–	55-154	15.5-40.4	4.5-9.4	0.035-0.144	([2])	51-100	Moderate
0.085-0.104	0.125-0.164	155-254	40.5-65.4	9.5-12.4	0.145-0.224	([2])	101-150	Unhealthy for sensitive groups
0.105-0.124	0.165-204	255-354	65.5-150.4	12.5-15.4	0.225-0.304	([2])	151-200	Unhealthy
0.125-0.374 (0.155-0.404)[4]	0.205-0.404	355-424	150.5-250.4	15.5-30.4	0.305-0.604	0.65-1.24	201-300	Very unhealthy
([3])	0.405-504	425-504	250.5-350.4	30.5-40.4	0.605-0.804	1.25-1.64	301-400	Hazardous
([3])	0.505-0.604	505-604	350.5-500.4	40.5-50.4	0.805-1.004	1.65-2.04	401-500	Hazardous

[1]Areas are required to report the AQI based on 8 hour ozone values. However, there are areas where an AQI based on 1-hour ozone values would be more protective. In these cases the index for both the 8-hour and the 1-hour ozone values may be calculated and the maximum AQI reported.
[2]NO_2 has no short term NAAQS and can generate an AQI only above a value of 200.
[3]8-hour O_3 values do not define higher AQI values ($\geq$301). AQI values of 301 or higher are calculated with 1-hour O_3 concentration.
[4]The numbers in parentheses are associated 1 hour values to be used in this overlapping category only.

Table 2: Category descriptor and color code for Bangladesh

Table 10. Suggested AQI Scheme for Bangladesh			
AQI Value	Level of Health Concern (স্বাস্থ্যগত উদ্বেগের অবস্থান)		Colours
	English	বাংলা	
0 - 50	GOOD	ভাল	GREEN
51-100	MODERATE	মধ্যম	YELLOW GREEN
101-150	CAUTION		YELLOW
151 – 200	UNHEALTHY	অস্বাস্থ্যকর	ORANGE
201 – 300	VERY UNHEALTHY	খুব অস্বাস্থ্যকর	RED
301 – 500	EXTREMELY UNHEALTHY	অত্যন্ত অস্বাস্থ্যকর	PURPLE

Table 3: Pollutant specific sensitive groups

When this Pollutant has an Index Value > 100	Sensitive Group
Ozone	Children/people with asthma
$PM_{2.5}$	People with respiratory/heart disease; specially children and the elderly
PM_{10}	People with respiratory disease
CO	People with heart disease
SO_2	People with asthma

Course Title: Structural Engineering VI	Course Code: CE 417
Time: 1 hour Credit Hour: 2.00	Full Marks: 40

Answer all the questions

QUESTION 1 [12 MARKS]

(i) With a neat sketch, explain the shear lag effect in a tension steel member. Explain the approach taken by the AISC to incorporate the shear lag effect for the design of tension member. [4+2]

(ii) Differentiate between snug-tight and slip-critical connections. [6]

QUESTION 2 [14 MARKS]

Two plates are connected by a lap bearing type joint with the bolt configuration as shown in **Figure 1** where 5/8-inch-diameter A490 (F_y = 130 ksi, F_u = 150 ksi) bolts in standard holes are used. The plates are A572 Grade 80 steel. If deformation at the bolt holes at service load is not a design consideration, determine the design capacity of the bolt connection considering shear and bearing strengths only. [14]
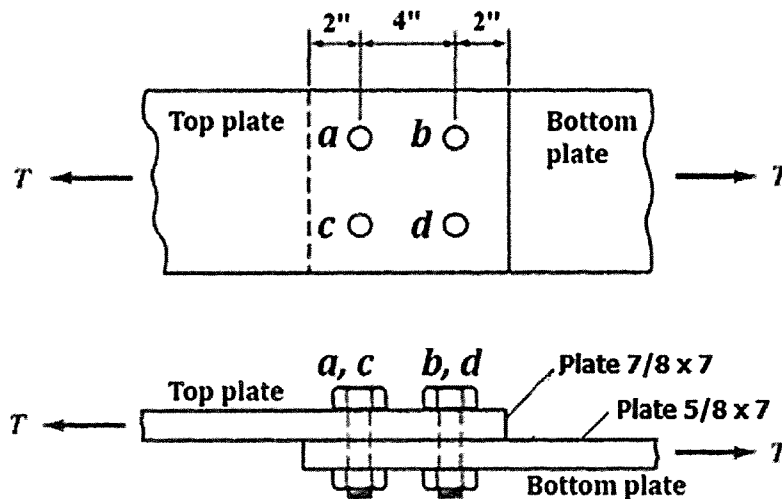

Figure 1

QUESTION 3 [14 MARKS]

A 20 ft long A36 (F_u = 52 ksi) steel tension member needs to resist a service dead load of 50 kips and a service live load of 80 kips. Select the lightest channel section from the following table to resist the loads. The tension member is connected to a gusset plate using 5 nos. 5/8-in bolts with standard holes as shown in **Figure 2**. Assume that the gusset plate has adequate strength in tension, and U = 0.80 for preliminary calculation (revise this value after selecting the section). Neglect block shear failure mode and follow **AISC-LRFD** method.

[14]

Shape	A_g (in²)	$\bar{x}$ (in)	$\bar{y}$ (in)	r_x (in)	r_y (in)	t_f (in)	t_w (in)
C12x30	8.81	0.674	6	4.29	0.762	0.501	0.510
C12x25	7.34	0.674	6	4.43	0.779	0.501	0.387
C15x40	11.8	0.778	7.5	5.43	0.883	0.650	0.520
C10x30	8.81	0.649	5	3.43	0.668	0.436	0.673
C15x50	14.7	0.799	7.5	5.24	0.865	0.650	0.716

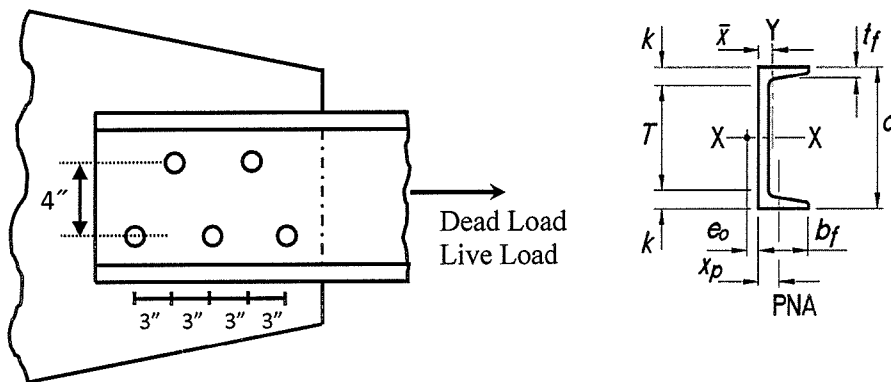**Figure 2**

FORMULA

1. $R_n = mA_bF_{nv}$

2. $R_n = 0.6F_yA_{gv} + U_{bs}F_uA_{nt}$

3. $R_n = 0.6F_uA_{nv} + U_{bs}F_uA_{nt}$

4. $R_n = 1.5L_ctF_u \leq 3.0dtF_u$

5. $R_n = 1.2L_ctF_u \leq 2.4dtF_u$

6. $R_n = 1.0L_ctF_u \leq 2.0dtF_u$

7. $R_x = \dfrac{My}{\Sigma d^2}$ and $R_y = \dfrac{Mx}{\Sigma d^2}$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
4ᵗʰ Year 2ⁿᵈ Semester

Course Title: Project Planning and Management	Course Code: CE 401
Time: 1 hour Credit Hour: 3.00	Full Marks: 60

Answer all the questions

QUESTION 1 [08 MARKS]

You are tasked with evaluating the potential for cost overruns in a newly proposed construction project. Based on the project's characteristics and your knowledge of factors affecting construction budgets, predict the most likely causes of cost increases. For each predicted cause, propose specific mitigation strategies that could be implemented proactively to minimize or prevent these potential cost overruns.   [04+04]

QUESTION 2 [05 MARKS]

You are overseeing a crew working at heights on a construction site. Apply your knowledge of Personal Protective Equipment (PPE) to select the appropriate PPE for this task, justifying your choices for each item based on the specific hazards involved.   [02+03]

QUESTION 3 [15 MARKS]

Information regarding different activities, their durations and dependencies of a small community park renovation project is shown in **Table 1**.

Table 1. Activities, their durations and dependencies of the project

Activity	Description	Duration (Days)	Predecessors
A	Design Finalization	4	-
B	Site Preparation & Grading	3	A
C	Playground Equipment Install	5	B
D	Planting Trees & Flowers	4	B
E	Pathway Construction	6	B
F	Bench & Lighting Install	3	C, D, E
G	Final Inspection & Cleanup	2	F

a. Employ your knowledge of bar diagram construction to create a visual representation of the project schedule. Predict the total project completion time.   [10]

b. The project manager reports that at the end of day 11, activities A, B and C are completed, activity D is 50% completed, and activity E is 33% completed. Analyze the project's progress using your bar diagram from part (a) and determine the impact on the overall project schedule. Propose specific actions the project manager should take to mitigate potential delays, justifying your recommendations.   [05]

QUESTION 4 [32 MARKS]

A research consortium is proposing an investigation into the seismic resilience of novel bridge designs. Based on the experimental methodology and anticipated data collection, a PERT network has been generated, detailing three different time estimates (optimistic, most likely, and pessimistic) for each research component as shown in **Figure 1**. Apply PERT network analysis techniques to determine the following critical project parameters:

a. The Expected Time for each activity.   [06]

b. The Earliest Expected Time and Latest Allowable Occurrence Time for each event.   [16]

c. The Slack Time for various events.   [03]

d. The Critical Path and Expected Project Duration. **Illustrate the Critical Path on the Network Diagram.**   [05+02]
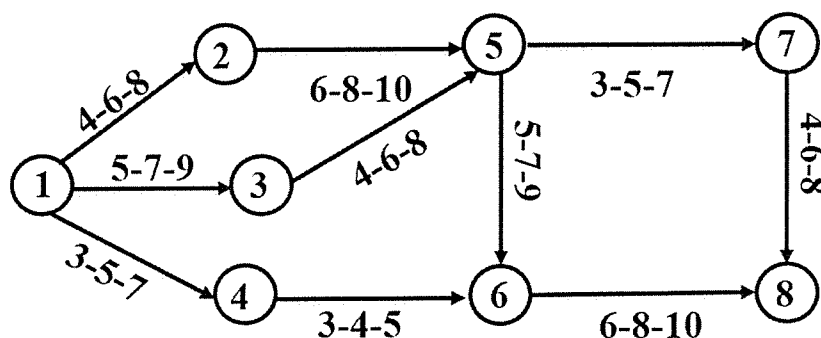

Figure 1. PERT network with different time estimates

....

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
4th Year 2nd Semester

Course Title: Environmental Engineering VIII   Course Code: CE 531
Time: 1 hour   Credit Hour: 2.00   Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

a. State the best way to describe spatial resolution.   [1]

b. Define the type of project that requires good temporal resolution and give two examples of such project.   [2]

c. Outline the parts of a passive remote sensing with a detailed figure.   [3]

d. List the advantages and disadvantages of low earth orbit satellites as a remote sensing data acquisition medium.   [4]

QUESTION 2 [10 MARKS]

a. Define spectral resolution.   [1]

b. Explain atmospheric windows in terms of electromagnetic spectrum.   [3]

c. Sate the special facts observed on the spectral reflectance curve for green grass.   [3]

d. In a grayscale image, recognize the translation of brightness to shades of color if an 8-bit scale is used.   [3]

QUESTION 3 [10 MARKS]

a. Identify how energy can be quantified by relating the energy's wavelength with its frequency and calculate which has more energy; violet or red light.   [5]

Table 1: Wavelength of the primary colors of the visible spectrum

Color	Wavelength
Violet	0.400-0.446 µm
Blue	0.446-0.500 µm
Green	0.500-0.578 µm
Yellow	0.578-0.592 µm
Orange	0.592-0.620 µm
Red	0.620-0.700 µm

b. Describe in short two types of Multi-Spectral Scanners. [4]

c. Calculate the number of detectors deployed in the Operational Land Imager (OLI) on the Landsat 8 satellite which has a swath width of 185 km and a spatial resolution of 30 meters for its multispectral bands. [1]

QUESTION 4 [10 MARKS]

a. Discuss the terms of Equatorial orbit and Polar orbit. [2]

b. Describe the applications of natural and artificial satellites. [2]

c. Compare between Geostationary and Sun synchronous satellite. [3]

d. Give two examples for each of the following satellites: Geostationary satellite, Sun synchronous satellite, Navigation satellite. [3]