

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

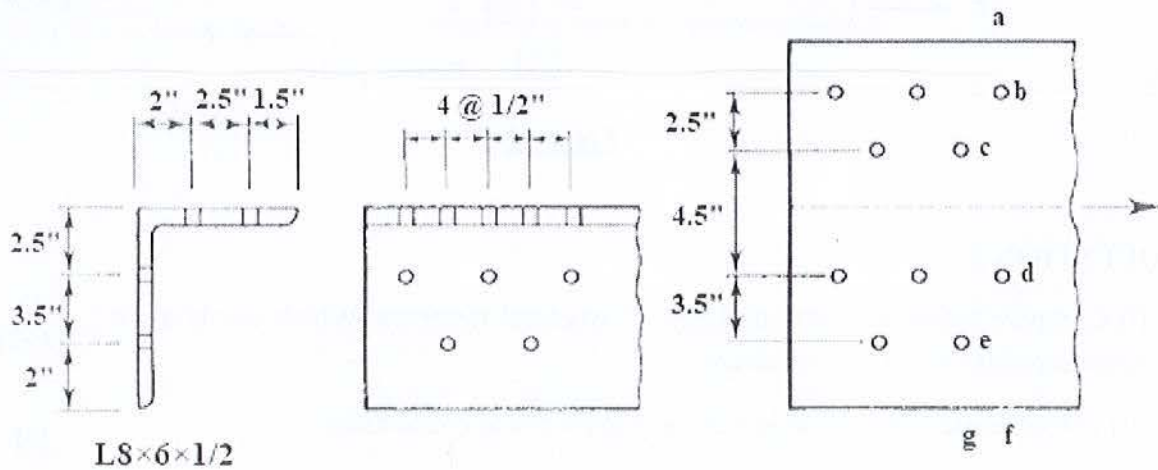
Course Title: Structural Engineering VI
 Time: 1 hour

Credit Hour: 2

Course Code: CE 417
 Full Marks: 60

QUESTION 1

An angle tension member, $L8 \times 6 \times 1/2$, is connected to another member with the bolt configuration shown in **Figure 1**. Both legs of the angle section are connected. The material is A36 ($F_u = 58$ ksi) steel and bolts are 5/8-inch dia. with standard holes. [20]
 Determine the design tension capacity of the angle member. Neglect block shear failure.



Section properties of $L8 \times 6 \times 1/2$:

A_g	\bar{x}	\bar{y}	k
(in ²)	(in)	(in)	(in)
6.80	1.46	2.46	1

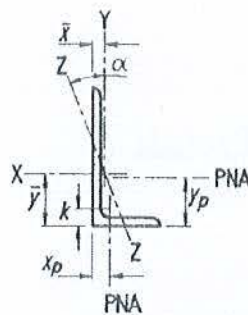


Figure 1

QUESTION 2

Two plates are connected by a lap bearing type joint with the bolt configuration as shown in **Figure 2**. The total service tension force (T) is 100 kips. If deformation at the bolt hole at service load is a design consideration, determine the minimum diameter of the bolt for the connection considering shear and bearing strengths only. Assume [20]

A325 ($F_y = 92$ ksi, $F_u = 120$ ksi) bolt is used in the connection, the plates are A572 Grade 60 steel, all bolts share equal amounts of tensile force, and threads are included in the shear plan. Use **AISC-ASD** approach.

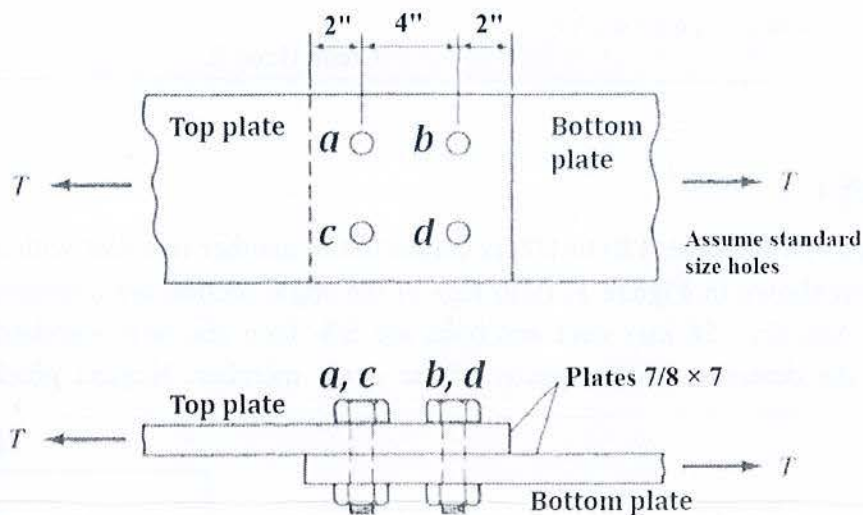


Figure 2

QUESTION 3

- (i) Compare between rivets and bolts as structural fasteners. Which one is more advantageous? Justify your opinion. [4+2]
- (ii) Differentiate between snug-tight and slip-critical connections. [6]
- (iii) With neat sketches, state the limit states that control the strength of a bolted connection. [8]

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. $R_n = 1.5L_{ct}F_u \leq 3.0dtF_u$
5. $R_n = 1.2L_{ct}F_u \leq 2.4dtF_u$
6. $R_n = 1.0L_{ct}F_u \leq 2.0dtF_u$

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

Course Title: Structural Engineering V (Prestressed Concrete)
Time: 1 hour

Credit Hour: 2 Course Code: CE 415
Full Marks: 50

Answer all THREE questions. Assume value for any missing data

1. Find the nominal moment capacity for the T-beam section shown in **Fig.1**. The beam is furnished with prestressed steel with an effective stress, f_{se} of 1200 Mpa. Material properties are: $f_{pu} = 1850$ Mpa, $f_c = 44$ Mpa. Given $x = 500$ mm. [15]

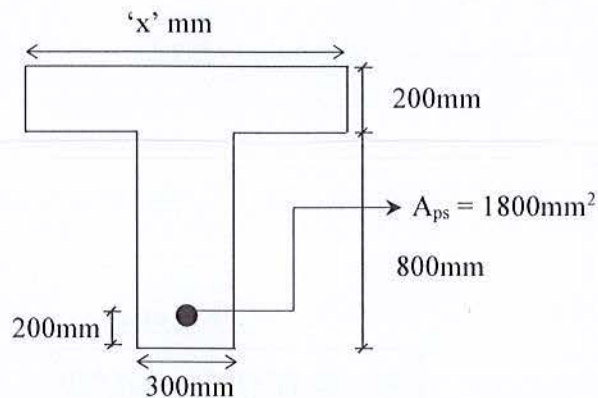


Fig.1

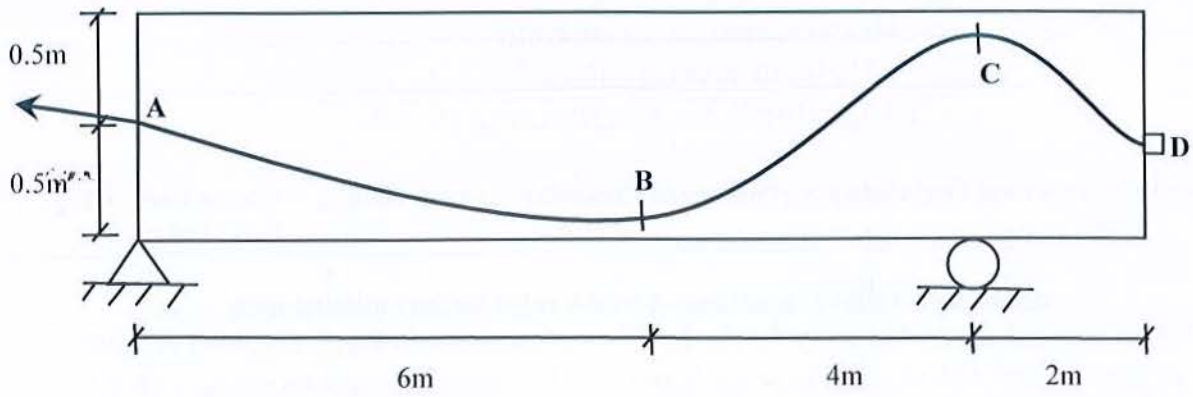
- 2.i) A simply supported, post-tensioned beam has the same concrete cross-section and prestressed steel as in **Fig.1**. The initial prestress in the steel is 1000MPa, which reduces to 90% of the initial after deducting all losses. Calculate the moment that can be carried by the beam for cracking in the bottom fibers at a modulus of rupture which is 10% of the concrete strength, $f_c = 44$ Mpa. Given $x = 1800$ mm.

ii) List separately the losses of prestress for pretensioned and posttensioned members. [15+5]

- 3.i) On a neat sketch, show the variation of stress in steel of a bonded post-tensioned beam.

- ii) An overhanging beam as shown in **Fig. 2** is posttensioned from the end 'A' with a force of 1400 kN. Find the amount of prestress remaining at point C on the tendon after losses due to friction. Solve using the **exact friction formula**. Given, co-efficient of friction (μ)= 0.40 and wobble effect (k) = 0.0033/m.

[5+10]



- ❖ $\alpha_{AB} = 0.18$
- ❖ $\alpha_{CB} = 0.12$

Fig.2

Formulae

$$f_{ps} = f_{pu} \{1 - 0.5\rho_p (f_{pu}/f_c')\}$$

$$\rho_p = A_{ps}/bd$$

$$\omega_p = (\rho_p * f_{ps}) / f_c'$$

$$F_2 = F_1 e^{-\mu\alpha - kL}$$

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

Course Title: Environmental Engineering IV
 Time: 1 hour

Credit Hour: 2.0

Course Code: CE 433
 Full Marks: 40

(Answer all the questions. All questions are of equal value. Figures in the right margin indicate marks)

1. a) Define sources of water pollution with examples. [5]
 b) State the assumptions of Streeter-Phelps Dissolved Oxygen model. [5]
2. a) Why CBOD is not equal to COD? Explain. [5]
 b) Discuss the zones of pollution in a streamflow with figure. [5]
3. a) Derive BOD rate equation assuming first order reaction. [5]
 b) A sample of wastewater has an ultimate BOD of 240 mg/L. The 5-day BOD of the sample was 200 mg/L. The temperature of the sample was 25 °C. Evaluate the BOD of the sample after 20 days if temperature rises to 30 °C? [5]
4. You are assigned to judge the water quality of a river based on the Dissolved Oxygen (DO) level where wastewater is discharged at a certain point. The details are given below. [10]

River	Wastewater
Q = 7.2 m ³ /s	Q = 0.8 m ³ /s
DO = 9.2 mg/L	DO = 2 mg/L
BOD ₅ = 1.50 mg/L	BOD ₅ = 180 mg/L
T = 25 °C	T = 35 °C

The reaeration rate and the deoxygenation rate are 0.50 d⁻¹ and 0.49 d⁻¹ at 20 °C, respectively. The guideline value for minimum DO necessary in the rivers and streams is 4.5 mg/L (ppm) for the survival of fishes and aquatic animals. What will you suggest?

Equations:

$$t_c = \frac{1}{k_r - k_d} \ln \left[\frac{k_r}{k_d} \left(1 - D_a \frac{k_r - k_d}{k_d L_a} \right) \right] \qquad D_c = \frac{k_d L_a}{k_r - k_d} (e^{-k_d t_c} - e^{-k_r t_c}) + D_a e^{-k_r t_c}$$

$$DO_{sat} = 14.62 - 0.394T + 0.007714T^2 - 0.0000646T^3;$$

$$D_t = \frac{k_d L_a}{k_r - k_d} (e^{-k_d t} - e^{-k_r t}) + D_a (e^{-k_r t})$$

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Mid Term Examination Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication
Time: 1 Hour

Credit Hours: 2.00

Course Code: CE 403
Full Marks: 40

Answer all the questions.

1. In which phase of a project a Feasibility Study is conducted? Which issues are addressed in this study? Which questions/answers are associated with these issues? Discuss briefly. [2+4+4]

2. Read the following case carefully:

Mr. 'X' is working as the team leader for preparing a proposal of constructing a six storied apartment building for retired government employees. In the final Project Proposal, he commits to complete the construction work in eight months. However, no Bar/Gantt chart (shows timeline for different activities of the project) is attached in the Project Proposal.

In view of the case study presented above, investigate whether the proposal has achieved a SMART objective. How will you prepare this proposal SMART? [10]

3. Briefly describe the essential elements of a legally binding contract? [10]

4. Which type of Contract is the most suitable for Civil Construction Projects? Why do you think that this type is the most suitable for Civil Construction Projects? Is there any problem associated with this type of Contract? Explain in brief. [2+4+4]

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Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering X
Time: 1 hour

Credit Hour: 2

Course Code: CE 425
Full Marks: 40

QUESTION 1

A very thick RCC raft foundation needs to be constructed for a nuclear power plant. This structure induces a very high gravity load on the foundation. Three types of cement (A, B and C) have been chosen and technical data sheets are collected to pre-investigate the performance of cement in order to find suitable concrete for that construction. Chemical compositions of cement are determined by X-ray fluorescence and presented in Table 1.

Table 1: Chemical constituent of cement (A, B and C)

Bulk Oxide Content	CaO	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	SO ₃	K ₂ O	Na ₂ O	LOI
A	60	20	12.5	3.8	1.2	0.1	0.1	0.4	1.9
B	65	21	7.5	3	1.3	0.3	0.3	0.5	1.1
C	61	22	8	4.5	1.2	0.2	0.7	0.7	1.7

(i) Find the cements that will provide higher heat and higher strength of concrete and then explain the impact of those cements on the performance of concrete. [12]

(ii) Based on the alumina modulus and Bogue analysis, propose a suitable cement for the raft foundation of nuclear power plant and justify your selection. [6]

QUESTION 2

Explain the reason of using air-entraining admixture in concrete. With the help of a neat sketch, describe the working mechanism of air-entraining admixture. [4+4]

QUESTION 3

Describe bleeding of concrete. Explain the effects of bleeding on concrete performance, and the measures need to be taken to prevent the bleeding. [2+3+3]

QUESTION 4

Compare ready mix concrete and site mix concrete by considering their advantages and disadvantages. [6]

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Program: B.Sc. Engineering (Civil)

Course Title: GIS and Remote Sensing
Time: 1 hour

Credit Hour: 2.0

Course Code: CE531
Full Marks: 40

[Answer all the questions. Assume reasonable data, if any]

1. Do you think it is necessary to know both the GIS and CAD data models as a Civil Engineer? Clarify your answer. [5]
2. "All Maps are WRONG"- Do you agree with that statement? Justify your answer. [5]
3. "The ideal geographic ORDBMS is one that has been extended to support geographic object types and functions"- Analyze this statement. [5]
4. "Test_Dhaka.jpg" contains information on the Dhaka district. Georeference the map in an appropriate coordinate system and create a polygon shapefile named "Dhaka_District_Area" to digitize the Dhaka district area. [5+5=10]
5. Create a shapefile of the country that starts with the first letter of the last name using google earth and ArcGIS. [5]
6. BIWTA and BWDB are two organizations that collect data on rivers. Data collection takes time for large rivers, so it is usually done in segments. The Ganges is one of the major rivers of Bangladesh. Let's say in one particular year, the Ganges river flooded about 10 km of the area around it. People of many districts were affected by this devastating flood. [5+5=10]
Use the 'District' and 'MajorRiver' shapefiles to complete the following tasks.
 - (i) Export the river Ganges to produce the shapefile as 'Ganges' as a single entity comprising all the little segments (Use the field BWDB_NAME for grouping).
 - (ii) Export the districts affected by flood (within 10 km from the Ganges river) to produce the shapefile as 'Flooded_districts'.