University of Asia Pacific
Department of Civil Engineering
Mid-Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
4th Year 1st Semester

Course Title: Structural Engineering X | Course Code: CE 425
Time: 1 hour | Credit Hour: 2.0 | Full Marks: 40

QUESTION 1 [8 MARKS] [8]

Explain the hydration of four main compounds of cement by illustrating heat evolution diagram.

QUESTION 2: [8 MARKS] [8]

Explain pozzolanic reaction in cement hydration and discuss the effect of blending fly ash with OPC in fresh and hardened concrete.

QUESTION 3: [8 MARKS] [8]

Explain the mechanism of superplasticizer in improving the workability of concrete. Also explain the effects of superplasticizer on fresh and hardened concrete.

QUESTION 4 [16 MARKS] [16]

An RMC plant is located 18 km from a construction site. It produces 28 m^3 of M35 grade concrete to be delivered in a transit mixer with a capacity of 7 m^3. The drum rotates at 12 rpm for 45 revolutions at the plant, then 9 rpm for the first 60 revolutions during transit, and 2 rpm for the remainder of the journey. The truck travels at 42 km/h, and the density of concrete is 2450 kg/m^3. Fuel consumption is 0.38 L/km, with a round trip distance equal to twice the one-way distance.

a) Calculate the mixing time at the plant before departure.
b) Determine the total travel time to the site.
c) Find the total fuel consumption for all trips.
d) Compute the total mass of concrete delivered.

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Course Title: Structural Engineering V | Course Code: CE 415
Time: 1 hour | Credit Hour: 2.00 | Full Marks: 60

Answer all the questions

QUESTION 1 [12 MARKS]

Describe briefly about the following topics:

a. The effect of **eccentric prestressing force** on stresses in a simply supported prestressed concrete. beam and illustrate with diagrams.
b. Why **high-strength concrete** is essential in prestressed concrete structures.
c. The importance of **ducts and grouting** in post-tensioned members.

[4+4+4]

QUESTION 2 [30 MARKS]

A prestressed concrete rectangular beam has a simple span of 11 meter and a cross section of 350 mm x 800 mm, carries a uniformly distributed dead load of 45 kN/m including self-weight and live load of 15 kN (triple), as shown in **Figure 1**. The prestressing is applied using 1530 mm^2 of straight high-tensile steel wires with an eccentricity of 170 mm, initially stressed to 1000 MPa, and anchored against bulkheads. The modulus of elasticity of concrete (E_c) is given as 33333 MPa, and that of steel is 200000 MPa. Analyze the beam to compute:

a. The **extreme fiber** stresses in the concrete at the midspan section using the Load Balancing Method (*3rd Concept*).
b. The stress of concrete **at the centre of gravity of steel (c.g.s) level** using the concept of the Exact Solution. [*Hints: use transform section*]

[15+15]

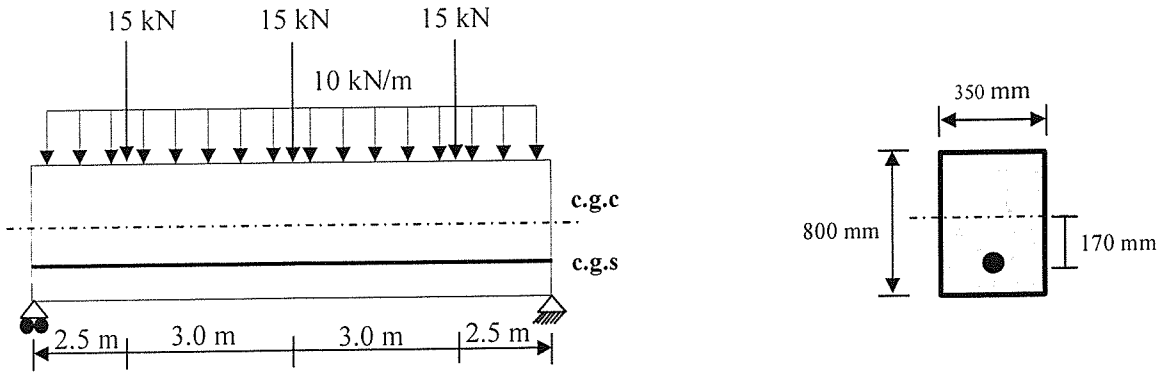

Figure 1: Simply supported beam with straight tendon

QUESTION 4 [18 MARKS]

A post-tensioned, bonded prestressed concrete beam is prestressed with low-relaxation steel strand having a total area of 1500 mm^2, as shown in **Figure 2**. The strands are jacked and anchored with an initial stress of 1350 MPa and eccentricity of 170 mm. The ultimate strength of strand (f_{pu}) is 1800 MPa, and relaxation loss is 17 MPa. The cross section of the beam is shown in **Figure 3**. The measured anchorage slip at the jacking end is 1 mm, the coefficient of friction is 0.35 and the wobble effect (k) is 0.0026 per meter. Now, **Calculate:**

a. The total instantaneous losses (Anchorage, Elastic Shortening, Friction)
b. The total time dependant losses (Relaxation, Creep, Shrinkage)

Assume, Material Properties:
Modulus of elasticity of concrete (E_c) = 33333 MPa
Modulus of elasticity of steel (E_s) = 200000 MPa
At transfer, compressive strength of concrete (f_{ci}) = 36 MPa
Ambient relative humidity (RH) = 75%

[9+9]

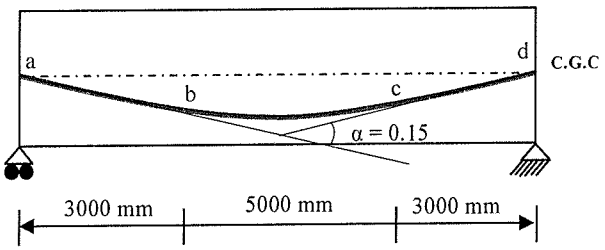

Figure 2: Long section of the beam

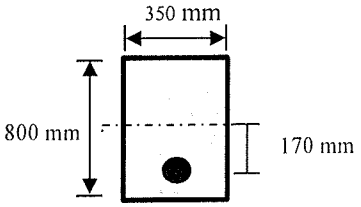

Figure 3: Mid span cross section of the beam

List of key Formulae:

Stress Calculation:	$f_C = -\frac{F}{A} \pm \frac{Fey}{I} \pm \frac{My}{I}$	$a = \frac{M}{T}$	$w_b = \frac{8Fh}{L^2}$
Loss Calculation:	$\log_e F = -kL$ $F_2 = F_1 e^{-kL}$	$83\gamma_h\gamma_{st} + \Delta f_P R$	$10\,x\,\frac{f_{pi}\,x\,A_{ps}}{A_g}\,x\,\gamma_h\gamma_{st}$
	$ES = \Delta f_s = \frac{E_s f_{cir}}{E_{c_i}}$	$\gamma_h = 17 - 0.01H$ $\gamma_{st} = \frac{35}{7 + f'_{c_i}}$	$\Delta f_s = \frac{n\,x\,F_i}{A_g + (n-1)A_s}$

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Mid Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
4th Year 1st Semester

Course Title: Irrigation and Flood Control | Course Code: CE 461
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

a. Derive an equation for estimating depth of irrigation water based on the concept of moisture content by volume. [4]

b. Wheat is to be grown in a field with a field capacity and permanent wilting point equal to 27% and 13% respectively. Find the available moisture in 80 cm depth of the soil, if the dry unit weight of the soil is 14.72 kN/m^2. If irrigation is to be supplied when the average moisture content falls to 18%, calculate the required irrigation depth. Also determine the frequency of irrigation if consumptive use is 2.5 cm/day. [6]

QUESTION 2 [10 MARKS]

a. State two considerations for choosing any source of irrigation water. [2]

b. i) Classify the irrigation water having the following characteristics: Concentration of Na, Ca and Mg are 40, 5 and 4 milli-equivalents per litre and the overall salt concentration is 280 milli-gram per litre at room temperature. [4+2+2]

Given are:
Atomic weight of sodium= 23
Atomic weight of calcium= 40
Atomic weight of magnesium= 24.3

ii) Identify two problems that may arise from using this water on fine textured soils.

iii) Provide remedies to overcome the quality issues.

QUESTION 3 [10 MARKS]

a. Define the relationship between duty and delta. Compute the value of duty for wheat, if wheat required 37.5 cm of water during the base period of 140 days. [6]

b. Compute the water application efficiency for the following information. 10 m^3/s of water is delivered to a 32 hectares field for 4 hours. Soil probing after the irrigation indicates that 0.3 meter of water has been stored in the root zone. Also determine the discharge at source if the conveyance loss is 15%. [4]

QUESTION 4 [10 MARKS]

a. Compute the gross irrigation requirement the given information. [10]
T_{max}= 34.8 °C, T_{min} = 25.6. °C, Relative humidity = 64 %, Wind speed U_2= 2 m/s, Net radiation in equivalent evaporation = 5 mm/day, c = 1.0, w = 0.85, Crop coefficient = 1.2, Effective rainfall = 1.6 mm/day, Percolation = 5 mm/day, Application efficiency= 85% and Conveyance efficiency= 75%.
[Hint: Use FAO Penman equation to calculate reference crop evapotranspiration
FAO Penman equation: $E_{t0} = c[wR_{ne} + (1-w)f(u)(e_s - e_a)]$,
Equation for calculating wind function: f(u)= $0.27(1+ U_2/100)$,
Equation for calculating vapor pressure: $e(T)$= $0.611 \exp[\frac{17.27T}{T+237.3}]$,
kpa]

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4th Year 1st Semester

Course Title: Transportation Engineering II | Course Code: CE 451
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 60

Answer all the questions

PART A

QUESTION 1 [13 MARKS]

a. Differentiate between flexible and rigid pavement. [5]
b. Draw with neat sketch different layers and load distribution pattern of flexible pavements. [4]
c. As a pavement engineer, you are assigned to select the most suitable type of rigid pavement for an expressway that carries heavy traffic and experiences freeze-thaw conditions. Which type would you choose, and why? Justify your selection. [4]

QUESTION 2 [7 MARKS]

The following results were obtained by a sieve analysis. Classify the soil according to the AASHTO classification system and calculate the group index. Discuss whether this material is suitable in its natural state for use as a subbase material. [7]

Table 1: Mechanical Analysis

Sieve No.	Percent Finer	Plasticity Test
10	30	Liquid Limit = 20
40	21	Plastic Limit = 15
100	18	
200	15	

PART B

QUESTION 3 [12 MARKS]

a. Differentiate between Cutback Bitumen and Bitumen Emulsion. [3]
b. Briefly discuss about the Vacuum Distillation process of refining bitumen from petroleum crude oil. [6]
c. Differentiate between ACV and AIV. [3]

QUESTION 4 [28 MARKS]

Determine the voids in mineral aggregate required for a paving mix to construct a pavement which loading capacity (ESAL) is 2×10^5. Table 2 and Table 3 shows data obtained from the Marshall test and requirements of aggregate gradation respectively. Evaluate whether the void content in the paving mix is adequate, given that the optimum bitumen content is 5.8% and the nominal maximum aggregate size is No. 8. Also, comment on the stability of the mix, stating whether the stability at the optimum bitumen content meets the specified limit provided in Appendix A2. [20 + 8]

Table 2: Marshall Method

Asphalt %	Weight of the specimen in Air (gm)	Weight of specimen in Water (gm)	Stability (lb)
5.0	1235	578	800
5.5	950	295	715
6.0	1025	622	570

Table 3: Required Limits for Mineral Aggregate Gradation

Sieve Designation	Required Gradation Range	Bulk Specific Gravity
Retained on 19 mm	0-5	2.65
Retained on 9.5 mm	15-70	2.70
Retained on 0.425 mm	20-50	2.75
Retained on 0.075 mm	25-65	2.85
Filler		2.50

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Course Title: Professional Practices and Communication | Course Code: CE 403
Time: 1 hour | Credit Hour: 2.00 | Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

Your firm has been hired to manage the "Green City Bridge Project," a major infrastructure development. The client, a newly formed municipal body, has a clear vision but limited experience with large-scale projects. They have provided a rough outline of the project scope and have a strict budget. As the project manager, you need to prepare a formal proposal to secure the contract and establish a professional relationship.

a. Based on the project's characteristics and the client's profile, explain which type of project proposal is most appropriate for this scenario and justify your choice with at least three reasons.
[05]

b. What are the five essential components of a project proposal you must include? **[05]**

QUESTION 2 [10 MARKS]

Your company is managing the "Coastal Highway Restoration Project" under a **Cost-Plus Contract**. The project involves repairing damage to a highway caused by a recent storm. The scope of work is difficult to define precisely due to

potential hidden damage beneath the surface. The client is a non-profit organization with a variable funding stream, but they are eager to begin work immediately to restore transportation access.

a. Based on this scenario, identify two major risks for your firm and two major risks for the client associated with this type of contract.
[04]

b. Propose two contractual mechanisms that could be put in place to mitigate the risks for both parties.
[06]

QUESTION 3 [10 MARKS]

Your civil engineering firm, 'AquaTech Solutions,' is bidding on a government project to construct a new water treatment facility. The Request for Proposal (RFP) for this project is highly detailed, outlining all technical specifications, a clear timeline, and a fixed budget. The government body has a robust procurement process and will not negotiate on terms.

a. Explain why a **Conventional Proposal** is the ideal format for this project, and how it differs from a **Negotiated Terms and Conditions** format.
[06]

b. List four key components that the conventional proposal should include in its General Conditions section.
[04]

QUESTION 4 [10 MARKS]

A contract for the "City Canal Dredging Project" includes a clause stating, "The Contractor shall pay a penalty of $500 for each day the project exceeds the agreed-upon completion date." During the project, unexpected complications arise, and it becomes clear the project will be delayed.

a. Based on this, what is the specific term for this type of penalty, and what is its purpose? **[03]**

b. Explain the difference between a **General Condition of Contract (GCC)** and a **Particular Condition of Contract (PCC)**. In which of these two sections would you expect to find the clause mentioned above? **[07]**

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