

PhD Qualifying Examination – Concrete Materials and Structures

Problem 1. (10%)

Please shortly explain the terms: (1) aggregates (2) pozzolans

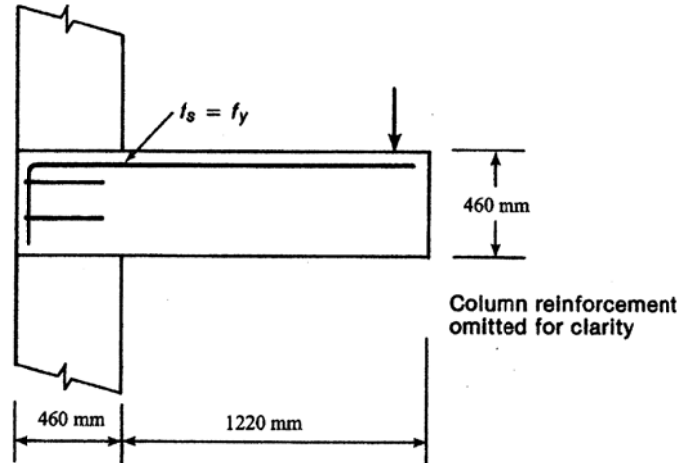
Problem 2. (10%)

Please plot the stress-strain curves for concrete materials and steel reinforcing bars.

Problem 3. (30%)

A cantilever RC beam shown in the figure has a width of 300 mm and an effective depth of 600 mm. It is flexurally reinforced with 3-#8 with 90° end hooks into the column. $f_c' = 20$ MPa and $f_y = f_t = 420$ MPa.

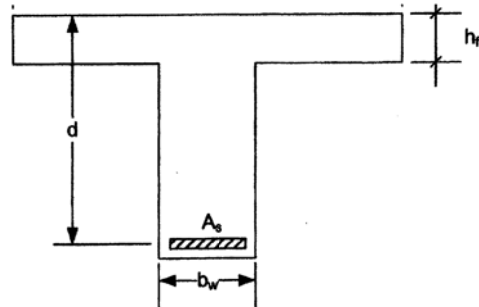
- 1) If the flexural reinforcement is designed to develop its yield strength at the face of the column, please check if the anchorage design of the 90° end hooks into the column is appropriate. Assuming that the side cover and end cover for the hook are 70mm and 51mm, respectively, there are transverse ties at hooks, and the c.t.c. distance of the ties are 150mm.



- 2) If the shear demand of the beam at the critical section is $V_u = 400$ kN, please design the transverse reinforcement of the beam at the critical section.

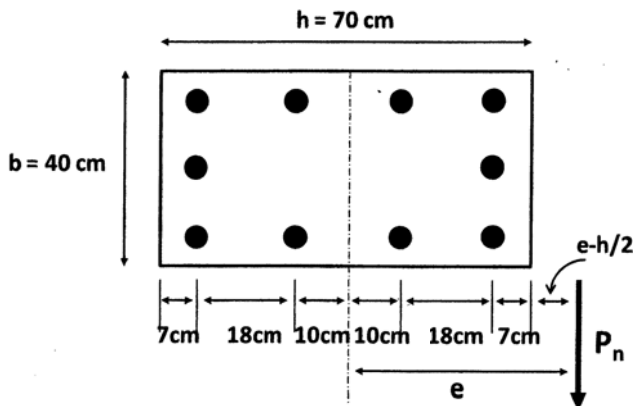
Problem 4. (25%)

An isolated T-beam, shown in the figure, has a flange width $b = 80$ cm, flange height of $h_f = 15$ cm, web width of $b_w = 30$ cm, beam depth of 80 cm. The tensile steel rebars consist of 6-D32, equally arranged in two rows with $d = 70.5$ cm, $d_t = 73.5$ cm. Assuming $f_c' = 21$ MPa and $f_y = 420$ MPa, find ϕM_n .



Problem 5. (25%)

The figure presents a cross section of a column. The column is longitudinally reinforced with 10-D32 steel bars. It has material properties: $f_c' = 28$ MPa and $f_y = 420$ MPa. If the column fails when the depth of the neutral axis reaches $c = 34$ cm, please find the nominal axial force capacity P_n and moment capacity M_n at failure.

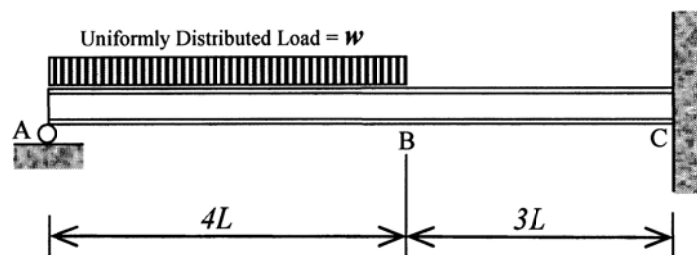


106 學年度第二學期博士學位候選人資格考試

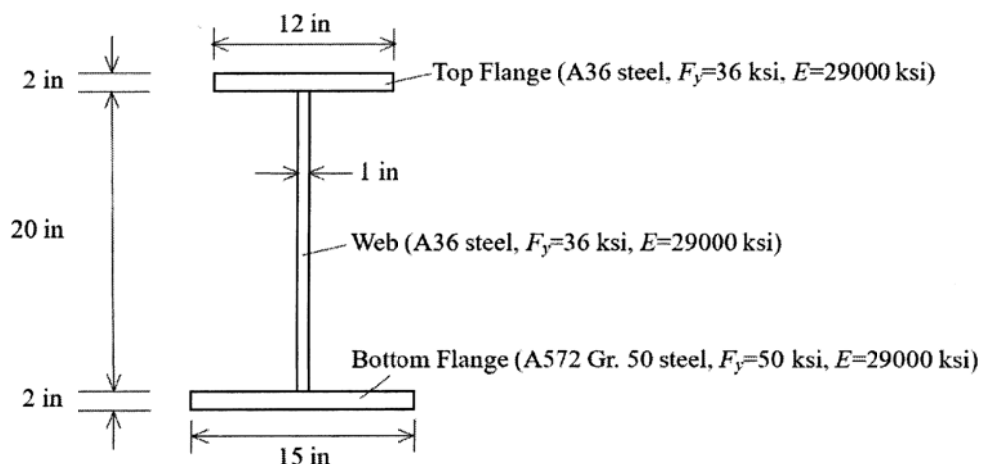
考試科目：鋼鐵材料與結構

考試方式: Closed Book考試時間: 100 分鐘

1. Discuss how edge dislocations and screw dislocations affect the strength and ductility of carbon steels at room temperature and elevated temperature. (20%)
2. Draw the iron-carbon binary phase diagram, and discuss the diagram. (20%)
3. Discuss alloying effects in steel materials by listing at least 5 different atomic species and explaining their effects on the mechanical properties of the steel materials. (10%)
4. Consider the following beam ABC subjected to a uniformly distributed load w along AB segment. The plastic moment of beam ABC is M_p . Please compute the plastic limit load (maximum load) of w . Show your answer as the function of M_p and L . (25%)



5. Consider the following steel beam. Please compute:
 - (1) The first yield moment M_y of this beam. (13%)
 - (2) The plastic moment M_p of this beam. (12%)
 (Note: Neglect flange local buckling & web local buckling of the following steel beam.)



1. Answer the following questions (25%)
 - 1.1. What is an example of a procurement activity that might be a valuable inclusion in a network?
 - 1.2. Conversely, what is an example of a procurement activity that has little merit for inclusion in a network?
 - 1.3. If "order tiles" requires a lead time of 45 days and "install tiles" can start right after "get surface ready for tiling" is finished, will you define the relationship between "order tiles" and "install tiles" as FS/45 ? Why? if not, what relationship would you define?
2. As a general contractor, you usually do not prepare contingency if you feel there is 70% or higher chance that the project can be finished with the contract project duration. You decide to conduct a PERT analysis to help you make decisions. Table I lists the project information required for PERT analysis.
 - 2.1. Find the mean and variance of each activity and determine all the paths of the network (15%)
 - 2.2. What is the longest contract project duration that you would not prepare contingency? (10%)
 - 2.3. Take a conservative approach, as shown in Table II, to decide whether you should prepare contingency, if the contract limit is 58 days? why?; if the contract limit is 53 days? why? (10%)

Table I

Activity	IPA (FS,0)	Duration (Days)			Mean	Var.
		To	Tm	Tp		
A	--	5	8	10		
B	--	10	12	14		
C	A, B	9	11	13		
D	A	10	17	28		
E	C	6	10	14		
F	D	4	7	13		
G	E, F	12	20	30		
H	--	27	32	45		
I	E, H	15	20	25		

Table II

			Z		Probability	
Path	Mean	Standard Deviation	58	53	P(T≤58)	P(T≤53)

3. You, as the project planner, are planning a residential community project consisting of 6 identical cabins. The required activities for completing **one cabin** are listed in Table III. Each activity is performed by the different trade. All hired crews of trades perform continuously once they start to work.
- 3.1. Develop a linear schedule for this project if each trade employs the same crew for all 6 cabins and identify the project duration. Shown your answer on Figure 1. (15%)
- 3.2. Develop a linear schedule for this project if each trade employs two different crews with the same productivity for all 6 cabins (two crews can't work at the same cabin concurrently) and identify the project duration. Shown your answer on Figure 2. (15%)
- 3.3. Which approach, employing one or two crews, you prefer to take If the cost of finishing activities for each crew is the same regardless cabins? or indifferent? (10%)

***You need to show the linear schedules of the both approaches and explain your reasoning.**

Table III The required activities for completing one cabin

Activity ID	Duration	Predecessors
A	1	--
B	3	--
C	2	(A, FS/0); (B, SS/2)
D	3	(C, FF/1)
E	4	(B, FS/0)
F	2	(D, FS/-1); (E, SF/3)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
6																																
5																																
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Figure 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
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Figure 2

1. You are going to develop a progress reporting system for a construction company. The construction company is considering a new system that will speed up the daily reporting process, as a system analyst, you are asked to develop a plan for determining system requirements.(30%)
 - 1.1. Set up 3 closed-end questions (at least three options for each question) that you might use in the interview with the construction manager.
 - 1.2. List possible techniques that you might use, why?
 - 1.3. Suppose the development budget is tight. How might that affect the process of system requirements determination. Indicate what techniques that you would choose over others, why?
 - 1.4. Suppose the development schedule is short. How might that affect the process of system requirements determination. Indicate what techniques that you would choose over others, why?

2. Please identify and explain the rule violations and formatting errors within the DFD shown in Figure 1. (15%)

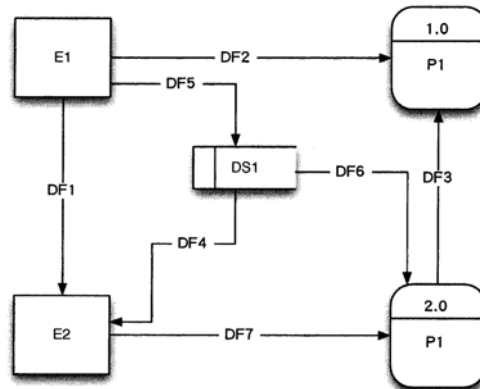


Figure 1

3. Describe what total specialization, partial specialization, disjoint, and overlap rules are. Give an example for each of them(15%)
4. Discuss the difference between a composite key and a composite attribute and give example for each one? (10%)
5. The following table structure contains many unsatisfactory components and characteristics (for example, there are several multi-valued attributes, naming conventions are violated, some attributes are not atomic, and so on)(30%)
 - 5.1. Given this structure, draw its dependence diagram. Label all transitive and /or partial dependences.
 - 5.2. Break up the dependency diagram to produce dependency diagram that are in 3NF. (Hint: you might have to create a few new attributes.)
 - 5.3. Using the results of problem 5.2, complete the E-R diagram which can show the relationships and the connectivity.
 - 5.4. Transfer the E-R diagram to a database by identifying the relation (table), the primary key and foreign keys.

ATTRIBUTE_NAME	Sample Value
EMP_CODE	1003
LAST_NMAE	Wilaker
EDUCATION	HS, BBA, MBA
DEPT_CODE	MKTG
DEPARTMENT	Marketing
DEPT_MANAGER	Jill H. Martin
JOB_CLASS	23
TITLE	Sale agent
DEPENDENTS	Gerald (spouse), Mary (daughter), John (son)
BIRTH_DATE	12/23/65
HIRE_DATE	10/14/94
TRAINING	level 1, level 2
BASE_SALARY	\$32,225

106 學年度第 2 學期博士學位候選人資格考試

高等瀝青材料學 (20% for each question)

1. Explain the following paragraph.

In the past, the mechanical characterization tests used were generally empirical in nature, but an effort has been made since the middle of 1980s to move towards measuring more fundamental engineering properties. Empirical tests are used less frequently now because they are not able to predict performance for conditions that are different than those under which the tests were developed.

2. Briefly describe the reasons to develop the superpave asphalt binder tests and specifications.
3. Briefly describe the procedures of the Marshall mix design and superpave mix design method.
4. Briefly describe the asphalt refining procedures.
5. Briefly describe the properties of an ideal pavement binder.