Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2016

BECM 3101

(Construction and Project Management I)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Define construction management from different points of view. Discuss the characteristics of project plan. (10)

   (b) Explain construction project development process with diagram. (08)

   (c) What do you mean by project organization? Discuss different types of project organization. (08)

   (d) Write down the pros and cons of the following: (09)
   - (i) Functional organization
   - (ii) Projectized organization
   - (iii) Matrix organization

2. (a) Define: (i) Slack Time (ii) Critical Path (04)

   (b) Write down the advantages and limitation of CPM technique. (06)

   (c) A project has the following characteristics: (25)

Activity	Preceding activity	Expected completion time (weeks)
A	None	5
B	A	2
C	A	6
D	B	12
E	D	10
F	D	9
G	D	5
H	B	9
I	C, E	1
J	G	2
K	F, I, J	3
L	K	9
M	H, G	7
N	M	8

(i) Draw a AOA network for this project.

(ii) Find the various paths and the critical path as well as the project completion time.

(iii) Prepare an activity schedule showing the ES, EF, LS, LF and float.

(iv) Will the critical path change if activity G takes 10 weeks instead of 5 weeks? If so, what will be the new critical path?

3. (a) Distinguish between CPM and PERT technique. (10)

(b) Analyse the following project by using PERT technique. The information is given (time estimates are in days) below: (25)

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Predecessor	-	-	A	A	B	B	C,D	E	C,D	G,H	F	J,K
Optimistic Time	2	1	4	3	2	5	3	2	3	1	4	2
Normal Time	2	3	7	5	6	9	6	6	5	3	8	5
Pessimistic Time	2	7	8	7	9	11	8	9	8	4	11	7

Draw the PERT network. Indicate the expected total float for each activity and hence indicate the average critical path. Within how many days would you expect the project to be completed with 99% chance?

4. (a) What is functional design process? Explain market demand and total cost relationship as economic feasibility study of a project (10)

(b) What is conceptual design process? Discuss top down design style with example. (09)

(c) What is project planning? Write down the steps for project planning. (09)

(d) What are WBS and OBS? Show how they are linked together with example. (07)

Section – B

5. (a) Define construction contract. Briefly discuss contract outline. "Never had contract with good person" – explain. (15)

(b) What are the conditions required to build a good construction contract? (10)

(c) What are the factors affecting and negotiating contract types. (10)

6. (a) How can you approach to cost estimation? Briefly discuss bid estimated. (10)

(b) Write short note on initial capital cost. What are the objectives of cost estimation? (10)

(c) Define contractor and subcontractor. When and why contractors are needed to appoint a subcontractor? Explain. (15)

7. (a) What do you mean by SLAM and DPM? Mention the steps in simulation and model building. (15)

(b) A project consists of five activities: (20)

i. Excavating a trench
ii. Laying a sub-base of gravel
iii. Laying a concrete pipe
iv. Backfilling
v. Compacting

Assume that the length of the pipe is 1050m and that the productivity rates for the five activities are 110, 135, 75, 200 and 200 per day, respectively. Draw the project diagram, using the LSM. Leave a minimum two-day-time buffer.

8. (a) Define PERT and GERT. What are the objectives of Gantt chart? How can you prepare a Gantt chart? (15)

(b) The total construction cost of a refinery with a production capacity of 200,000 bbl/day in Gary, Indiana, completed in 2008 was $100 million. It is proposed that a similar refinery with a production capacity of 300,000 bbl/day be built in Los Angeles, California, for completion in 2012. For the additional information given below, make an order of magnitude estimate of the cost of the proposed plant. (20)

1. In the total construction cost for the Gary, Indiana, plant, there was an item of $5 million for site preparation which is not typical for other plants.
2. The variation of sizes of the refineries can be approximated by the exponential rule, Equation, with m = 0.6.
3. The inflation rate is expected to be 8% per year from 2008 to 2012.
4. The location index was 0.92 for Gary, Indiana and 1.14 for Los Angeles in 2008. These indices are deemed to be appropriate for adjusting the costs between these two cities.
5. New air pollution equipment for the LA plant costs $7 million in 2012 dollars (not required in the Gary plant).
6. The contingency cost due to inclement weather delay will be reduced by the amount of 1% of total construction cost because of the favorable climate in LA (compared to Gary).

On the basis of the above conditions, the estimate the order of magnitude for the new project.

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BECM 3107

(Construction Contract and Law)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What is project proposal? How the bid package is prepared? (09)
   (b) Differentiate between addenda and project specifications. (09)
   (c) Write down the procedure for preparing construction contract. (08)
   (d) What is project commissioning? How the bid documents are included with input from the commissioning agent? (09)

2. (a) What is construction contract? Why a specific clause prevails over a general one while interpreting a contract? (08)
   (b) Write short note on: (18)
   (i) Patent ambiguity (ii) Latent ambiguity (iii) Contra proferentem.
   (c) Define contract administration. Discuss the liabilities of A/E for contract administration. (09)

3. (a) Define contract change and construction change directive? Write down the rules for construction change directive. (10)
   (b) What is cardinal contract change? How the equitable adjustment is performed during contract change? (08)
   (c) What do you mean by termination of contract? When the termination of contract may go wrongful? (07)
   (d) Under what circumstances the contractor may be terminated by the owner? What are the terminated contractor's responsibilities? (10)

4. (a) What do you mean by Owner-Controlled Insurance Program (OCIP). Write down the benefit of OCIP. (08)
   (b) What is letter of credit (LOC)? How LOC is issued? (09)
   (c) Distinguish between : (18)
   (i) Surety Bonds vs. Traditional Insurance
   (ii) General Liability vs. Wrap-up Liability
   (iii) LOC vs. Performance bond

Section – B

5. (a) Define the typical "organs of the state"? List and discuss some of the countries whose legal systems are based on the "English Common Law". (12)

   (b) Discuss the major legal system of the world. What is the legal system in Bangladesh? (06)

   (c) What is contract? What are the main elements of a contract? (10)

   (d) What are the major branches of common law? (07)

6. (a) Draw a flow chart showing "Law of Tort" and its element. (07)

   (b) Define: (i) Plaintiff (ii) Defendant (iii) Tort of Negligence (iv) Duty of Care (08)

   (c) What are the three different types of harm arise from tort of negligence? (05)

   (d) Discuss the "Spartan Steel Vs. Martin (1972)" case of pure economic loss. (15)

7. (a) What are the typical construction claims? Briefly discuss construction claims against owners and contractors. (12)

   (b) What are the traditional dispute resolution techniques? Briefly discuss them. (08)

   (c) Briefly define and explain the following: (15)
   (i) Mediation (ii) Arbitration (iii) Expert Determination (iv) Contract Negotiation
   (v) Litigation

8. (a) Why 90% to 95% of construction claims are settled through negotiations right up to court dates? (08)

   (b) Discuss the pre-trial procedures for civil cases. (05)

   (c) What are the factors that affect the validity of a contract? (08)

   (d) What are the remedies for breach of contract? (07)

   (e) Show the flow diagram for assessment of "a claim in negligence". (07)

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BECM 3115

(Climate and Architectural Design)

Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Figure out the importance of climate study for a BECM graduate. (10)
   (b) Analyse five major factors of "Global Climate Variations" in different geographic locations. Give example. (25)

2. (a) Compare the characteristics of Hot-dry climate with those of Warm-humid climate. (20)
   (b) How does the earth keep thermal balance by equaling incoming and outgoing radiator? Show with diagram. (15)

3. (a) Evaluate the forces that are interacting to generate global wind pattern in different latitude of both north and south hemisphere. (20)
   (b) Asses the impacts of "annual wind shift" from north to south of the equator. (15)

4. (a) Identify the local factors that are responsible for developing a site or micro climate. Which is different from regional or macro climate of the same area? (25)
   (b) Explain the major issue of "Ecological Consideration" that are taken care by a built-environment designer. (10)

Section – B

5. (a) Write short notes on: (15)
   i) Context, ii) Comfort and iii) Man Made Environment.
   (b) Explain the human body heat exchange process. (20)

6. (a) What are the factors of Climate Comfort? Explain with examples. (15)
   (b) What are the thermal comfort ideas? (05)
   (c) Explain with necessary sketches and examples. (15)
   i) ET, ii) CET and iii) Bio climatic chart

7. (a) Specific the heat exchange process for a built environment with necessary sketch and example. (20)
   (b) What is the thermal balance equation? (05)
   (c) What is effective shading? Explain with sketches. (10)

8. (a) Specify various types of shading devices with necessary sketches. (15)
   (b) Explain the following topics with examples. (06)
   i) Tube House, ii) Organic Architecture, ii) Green building movement and iv) Contemporary building materials.

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CE 3111

(Structural Analysis and Design-I)

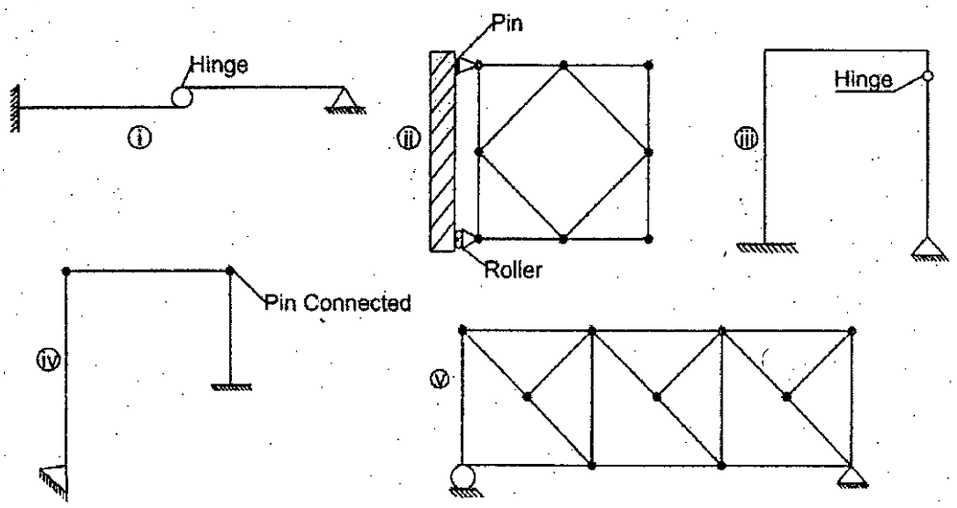
Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

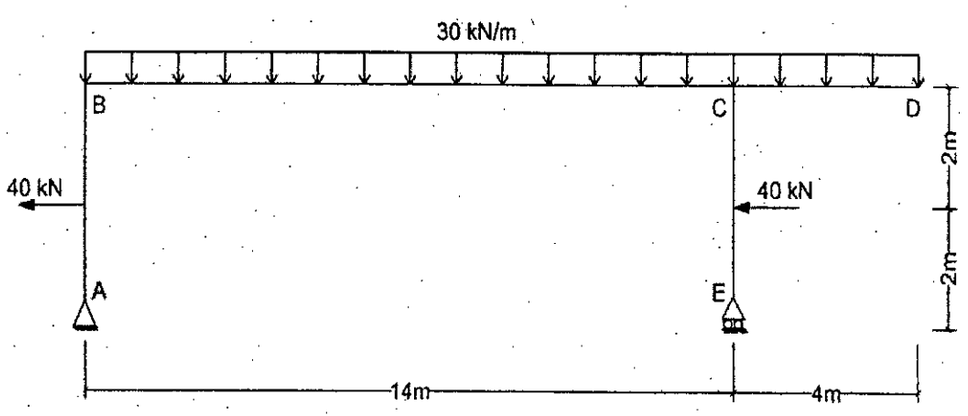
Section – A

1. (a) Define conjugate beam method. What are the basic characteristics of conjugate beam over real beam? (05)

(b) Classify the structures shown in the figure below. Check the structures whether stable or unstable and also find the structures statically determinate or indeterminate. (10)

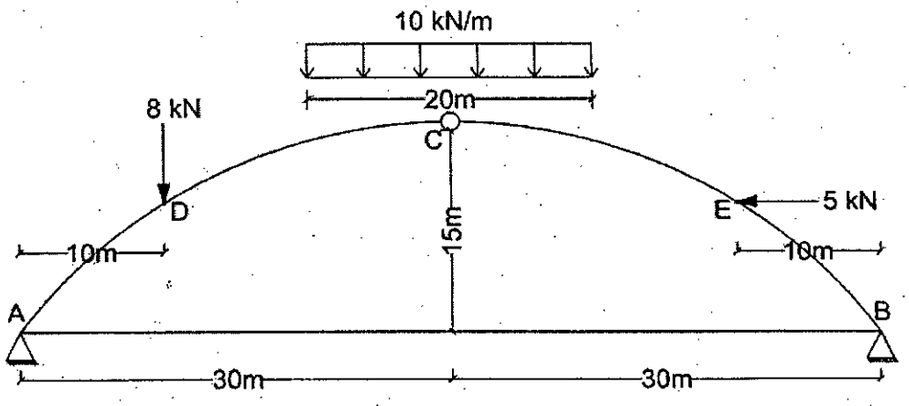


(c) Draw the shear force and bending moment diagram of the structure shown in the figure below. (20)

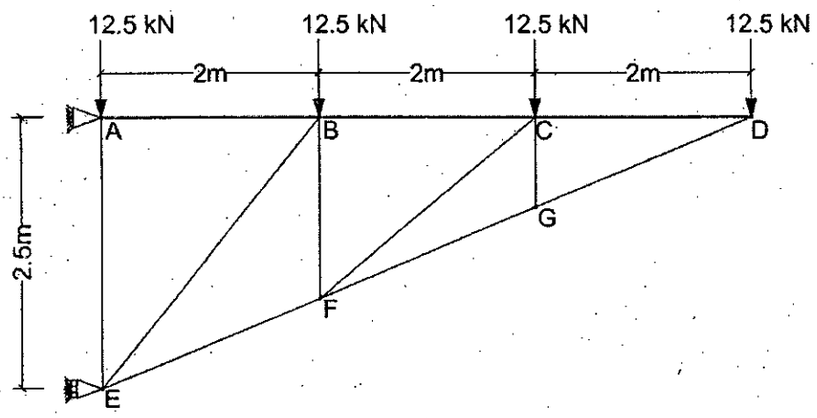


2. (a) Define sustained and design wind pressure. What are the factors which magnitude of wind depends on? (05)

(b) Determine the bending moment at 25m from the right hand support of the three hinged parabolic arch as shown in figure below. (11)



(c) Compute the bar force of the truss members FG, GD, CB and CF shown in following figure. By using method of joints. (13)



3. (a) Calculate the design wind load at each floor level for a 4 stories building from the data given below: (17)

- Height of each floor = 4m
- Structural importance co-efficient = 1.5
- Exposure category = B
- Basic wind = 180 kmph
- Pressure coefficient = 1.5

Plan area for the building is shown in figure below.

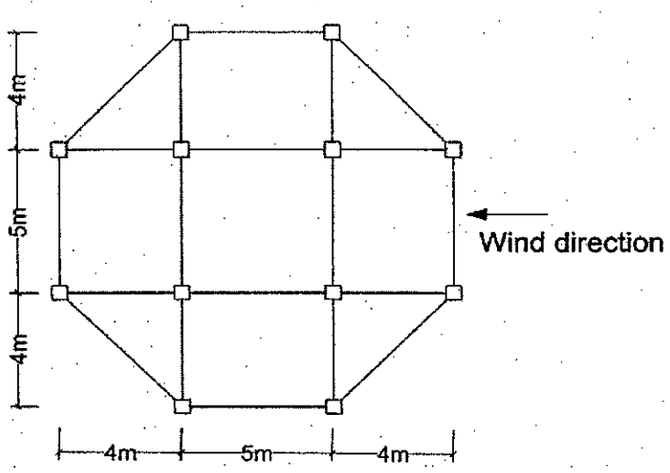


Fig: Column layout plan of the building

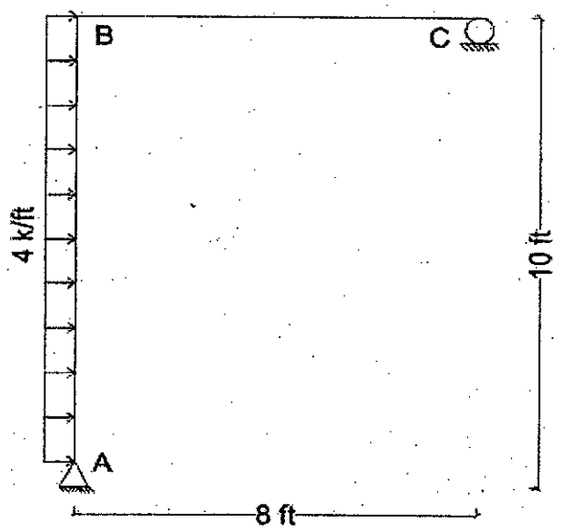
Table: Gust response factor G_h and G_z and combined height and exposure co-efficient C_z

Height above ground level(m)	G_h and G_z		C_z	
	Exposure B	Exposure C	Exposure B	Exposure C
0-4.5	1.32	1.15	0.80	1.20
6	1.29	1.14	0.87	1.26
9	1.26	1.12	0.97	1.37
12	1.23	1.11	1.06	1.45
15	1.22	1.10	1.13	1.52
18	1.20	1.09	1.19	1.57

(b) Calculate the earthquake load at each floor for a four storied residential reinforced concrete building for the data given below: (18)

- Height of each floor = 4m
- Plan area = 20m X 30m
- Seismic zone co-efficient = 0.15
- Structural importance co-efficient = 1.5
- Response modification co-efficient = 8
- Site co-efficient for soil characteristics = 2.0
- Seismic dead load = 2200 kN/floor

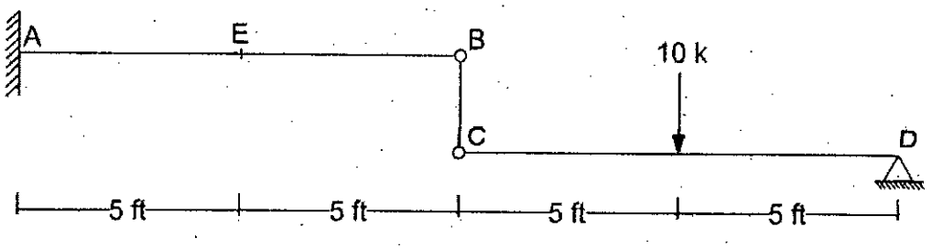
4. (a) For the frame shown in the figure below, find out the horizontal deflection at C by unit load method. Assume E = $29X10^3$ Ksi and I = 600 in^4 for both member. (15)



(b) Using conjugate beam method find for the following figure. (20)

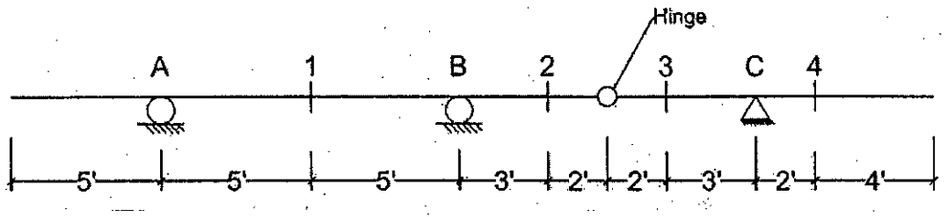
1. The deflection of B and C
2. The deflection of E
3. The slope at B
4. The slope at D

Where E = 30,000 k/in^2, I = 100 in^4.

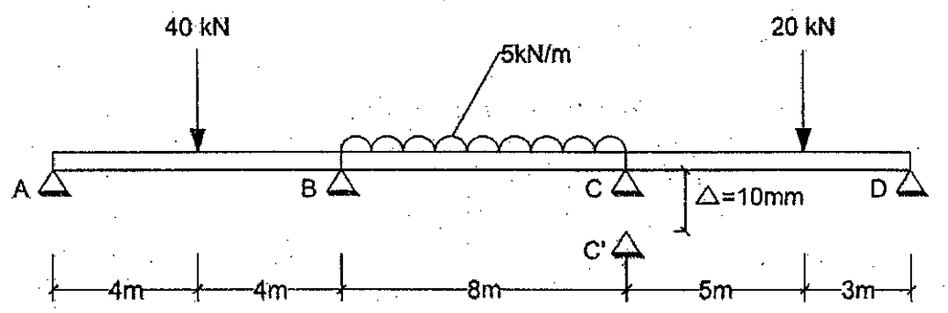


Section – B

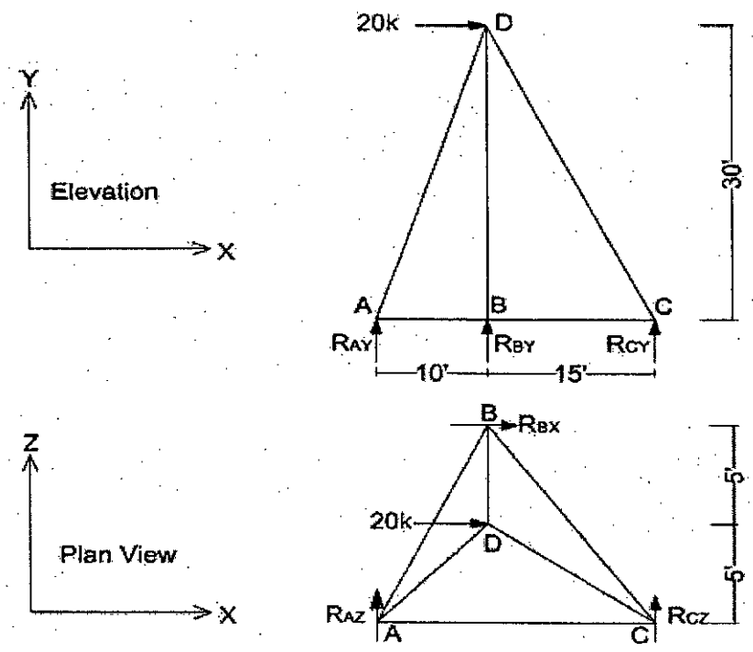
5. (a) Draw the influence lines with ordinate for the flowing structure. (20)
   (i) Vertical reaction at C.
   (ii) Shear at 1, 2, 3 and 4.



(b) Using three moment equation, analyze the flowing continuous beam owing to a settlement at support C of 10mm. Find out the unknown support moment and draw the movement diagram. Take EI as constant. (15)



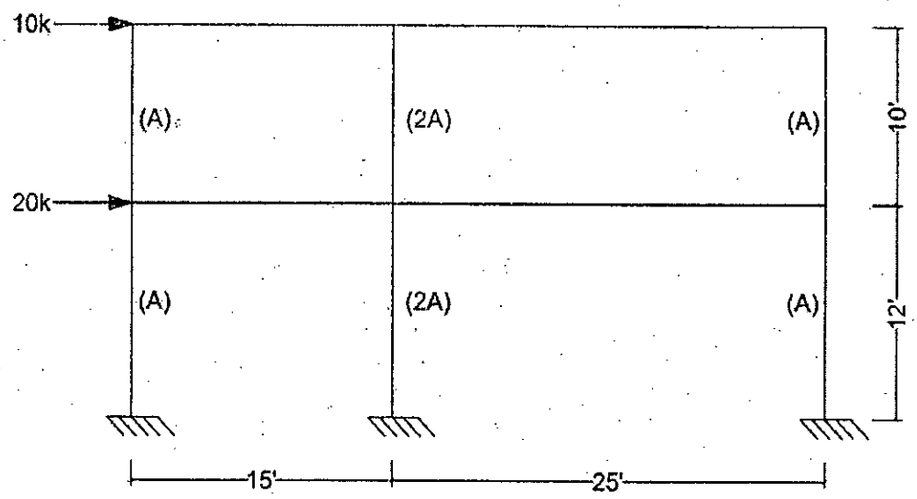
6. (a) Find out the reactions and bar forces of the flowing space truss. (20)



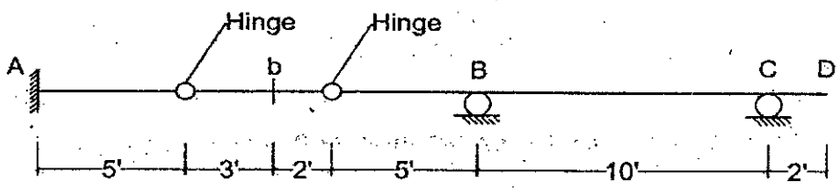
(b) A bridge cable suspended between two piers 60m apart carries a load of 2000kg/m throughout the span. The top of the piers are at the same level and the cable at its lowest point sags 10m below this level. Calculate the maximum value of the cable tension. What will be the tension in the back-stay and pressure on the pier if the cable passes over saddles and back-stay is inclined at 30^0 to horizontal? (15)

7. (a) Write down the assumptions made in the analysis of building frame subjected to lateral loads by portal and cantilever method. (07)

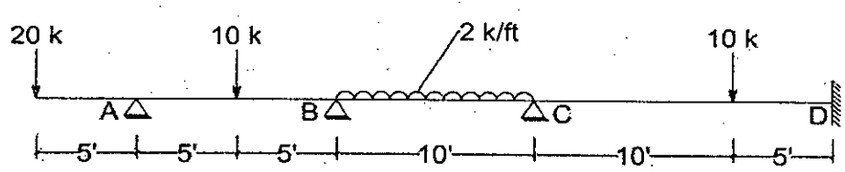
(b) Analyze the building frame shown figure below subjected to lateral loads by cantilever method. Area in parenthesis is also shown in the figure for each column. (28)



8. (a) Draw the influence lines for the flowing structure. (17)
   1. Vertical reaction at A
   2. Shear and moment at b
   3. Shear at just left and right of B.



(b) Using the three moment equation, analyze the continuous beam shown in figure below. Draw the shear and moment diagram. Sketch the elastic curve. Take $E=30x10^6$ psi and $I = 1000$ in^4 (18)



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CE 3113

(Reinforced Concrete Structures-I)

Full Marks: 210 Time: 3 hrs

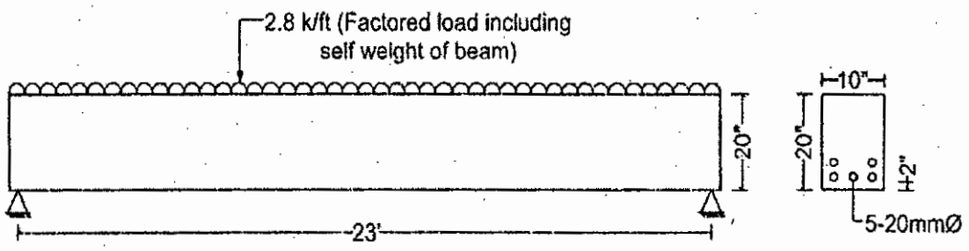
N.B. i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What do you mean by under reinforced, over reinforced and balanced design? What type of design is preferable and why? (10)

   (b) A RC beam shown in figure below. Span length of the beam is 23 ft. Determine (25)
   i) Maximum factored applied moment.
   ii) Usable moment capacity of the beam.
   iii) Is the beam is acceptable based on ρ_{max}?

   Given f_y = 60 ksi and f_c' = 3 ksi.



2. (a) What are the reasons for designing a beam with compression reinforcement? (05)

   (b) Explain briefly the importance of concrete clear cover for reinforced concrete members. (05)

   (c) A rectangular beam that must carry a service live load of 2.5 kips/ft and a calculated dead load of 1.10 kips/ft on an 20 ft simple span is limited in cross section for architectural reasons to 10 inch width and 22 inch total depth. It is reinforced for compression bars in one row, the center of which is 2.5 inch from the upper surface of the beam, and for tension with bars in two rows, the center of the lowers row being 3 inch above the lower surface of the beam. If f_y = 60,000 psi and f_c' = 3000 psi, what steel areas must be provided? Design the beam by USD method and show reinforcement details. (25)

3. (a) Discuss with example how an inverted 'T' beam can function structurally. (05)

   (b) Explain the fundamental propositions on which the mechanics of reinforced concrete is based. (10)

   (c) A tensile reinforced T- beam is to be designed to carry a uniformly distributed load on a 24 ft simple span. The total ultimate moment at mid span due to all loads is 6400 kips-inch. Concrete dimensions as governed by web shear and clearance conditions are b = 47 inch, bw = 11 inch, hf = 3 inch and d = 20 inch. What tensile reinforcement is required at mid span if f_c' = 3000 psi and f_y = 60,000 psi. Design the beam by USD method and show reinforcement details. (20)

4. (a) Design a lintel over a window 5'-0" wide. The wall is 10 inch thick. The height of the wall above the lintel is 6 ft. If f_c' = 2500 psi and fs = 20000 psi. (15)

(b) A rectangular reinforced beam has dimensions b = 12 inch, d = 21 inch, and h = 24 inch, and is reinforced with three No.10 bars. Material strengths are f_y = 60,000 psi, f_c' = 4000 psi and concrete tensile strength in bending (modulus of rupture) is 475 psi. (20)

i) Find the moment that will produce the first cracking at the bottom of the beam based on calculation of I_g (Gross moment of inertia).

ii) Calculate the Iut, the moment of inertia of the uncracked transformed section.

Section – B

5. (a) What is corner reinforcement? Show the ACI code provisions for the corner reinforcement in a neat sketch. (07)

(b) Design the corner panel of a two-way slab of a university residential student hall, having panel size of 20 ft x 20 ft center to center, where width of supporting beams are 12 inch on all sides. A service live load of 80 psf is distributed over the roof surface and a floor finish of 20 psf is added to the self weight of slab. (28)

Use f'_c = 3000 psi and f_y = 60,000 psi. Show the reinforcement detailing of slab in a neat sketch.

C_a (-ve) = C_b (-ve) = 0.05, C_a (+ve) DL = C_b (+ve) DL = 0.027

C_a (+ve) LL = C_b (+ve) LL = 0.032

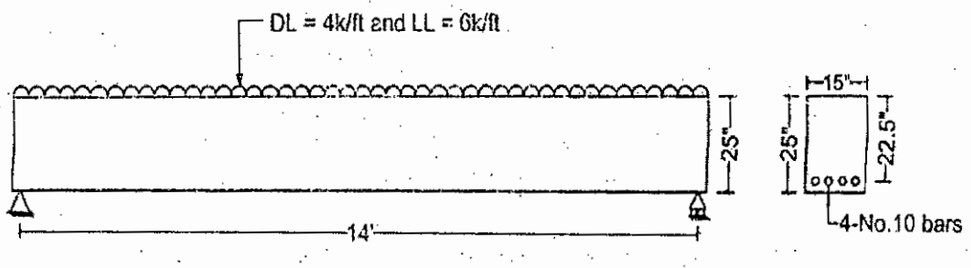
6. (a) Why temperature and shrinkage reinforcements are suggested by the ACI code for one-way slab design? Explain briefly. (08)

(b) Design a continuous one-way solid slab supported on beams and spaced at 15 ft. Beam width of 12 inch is provided on column lines, thus the clear span of slab is 14 ft. The slab carries a uniform live load of 100 psf and a floor finish of 20 psf in addition to its self weight. Use f'_c = 4000 psi, f_y = 60,000 psi and also the ACI moment co-efficient. Follow WSD method and also show the reinforcement details in a neat sketch. (27)

7. (a) Which region of the beam is required by web reinforcement to prevent shear failure? Explain briefly. (04)

(b) What is the difference between nominal strength and design strength? (03)

(c) Select No. 3 U-shaped stirrups for the beam shown in figure below for shear design. The beam is simply supported and uses normal weight concrete with strength of 4000 psi and grade 60 steel. Determine which part of the beam is required by web reinforcement. Also design the web reinforcement for the beam. (28)



8. (a) Define development length? What are the factors which influence the development length? (06)

(b) Show dimensional details of hooks used for main reinforcement according to ACI code. (06)

(c) What is 'top bar' and 'bottom bar'? Why does ACI suggest different values of bond stress for top and bottom bars in the same reinforced concrete member sufficiently deep? (06)

(d) Calculate the required length of deformed bars in the following case: (12 inch of concrete below top reinforcement). Assume that #3 stirrups are used for shear, and stirrup spacing based on shear calculations is 6 inch throughout the beam, S = 6 in., d = 15 in., $A_{s\ required}$ = 1.6 in^2. 3 #7 bars top reinforcement in a single layer in a beam with No. 3 stirrups. f'_c = 4000 psi and f_{yt} = 60,000 psi. Clear spacing between bars is equal to one inch. The bars are epoxy coated. Given values are α = 1.3, β = 1.5, γ = 1.0, and λ = 1.0. (17)
