Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2019
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) What is a project? Outline its features clearly with the help of an example. (10)
   (b) Who are the stakeholders in construction project? How important are the stakeholders? (07)
   (c) Why do projects need planning? What does it involve to make a project successful? (08)
   (d) Explain construction project development process with diagram. (10)

2. (a) What are the common stresses in project? Discuss about the psychology of a good project to make a project successful. (13)
   (b) Why a project should be organized? Analyze the pros. and cons. of matrix and projectized organization. (12)
   (c) Explain with the help of a diagram the concept of the triple constraint and its effect on a project. (10)

3. (a) Describe briefly how you transform a WBS into a network diagram. Why WBS and OBS are linked together? (08)
   (b) What is conceptual design process? Explain market demand and total cost relationship as economic feasibility study of a project. (12)
   (c) A simple project of erection of steel works for a shed has the following various elements. Draw a network for this project. (15)

Activity	Description
A	Erect site workshop
B	Fence site
C	Bend reinforcement
D	Dig foundation
E	Fabricate steel work
F	Install concrete plant
G	Place reinforcement
H	Concrete foundation
I	Paint steel work
J	Erect steel work
K	Give finishing touch

4. (a) Define the following terms: (i) Free float (ii) Independent float (iii) Dammy activity (iv) Optimistic time (v) Pessimistic time (10)

(b) A small project consisting of eight activities has the following characteristics:

Activity	Preceding activity	Most optimistic (a)	Most likely (m)	Most pessimistic (b)
A	-	2	4	12
B	-	10	12	26
C	A	8	9	10
D	A	10	15	20
E	A	7	7.5	11
F	B, C	9	9	9
G	D	3	3.5	7
H	E, F, G	5	5	5

(i) Draw the PERT network for the project.
(ii) Determine the critical path.
(iii) Prepare the activity schedule for the project showing total float, free float and independent float.
(iv) If the project manager wants to be 99% sure that the project is completed on the schedule date, how many weeks before that date should be started the project work?

Section – B

5. (a) Define construction contract from a legal point of view. Write down the objectives of cost estimation from the perspective of different stakeholders associated with construction. (10)

   (b) What are the suitability of cost reimbursement contract? Briefly explain the main aspects of unit price contract. (15)

   (c) Suppose you have to choose either Lump Sum contract or Guaranteed Maximum Price (GMP) contract. Which type of contract do you select and why? Explain with examples. (10)

6. (a) Describe the construction project development process from contractor's prospective. (10)

   (b) Why subcontractors are needed in construction industry? Write short notes on: (i) Domestic subcontractors (ii) Nominated subcontractors (iii) Named subcontractors (12)

   (c) Describe the bid unbalancing and front payment method as a part of a bidding strategy. (13)

7. (a) What is value engineering? Briefly describe the six steps of value engineering job plan in construction sector. (10)

   (b) Suppose the field supervision cost of a high-rise residential building project in Khulna city is $ 2x with a total cost of $ 4y. The minimum and maximum general office overhead charged to the project is 2% and 4% of total field cost respectively. Calculate the average bid price for this project in terms of x and y if the profit is nil. (10)

   (c) The total construction cost of a refinery with a production capacity of 200,000 bbl/day in Gary, Indiana, completed in 2001 was $100 million. It is proposed that a similar refinery with a production capacity of 300,000 bbl/day be built in Los Angeles (LA), California, for completion in 2003. For the additional information given below, make an order of magnitude estimate of the cost of the proposed plant. (15)

(i) 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.
(ii) The variation of sizes of the refineries can be approximated by the exponential rule equation with m = 0.6, $y = y_n\left(\frac{Q}{Q_n}\right)^m$ where,

y = Unknown cost for new facility, y_n = known cost for existing facility, Q = capacity of new facility, Q_n = capacity of existing facility

(iii) The inflation rate is expected to be 8% per year from 1999 to 2003.
(iv) The location index was 0.92 for Gary, Indiana and 1.14 for LA in 1999. These indices are deemed to be appropriate for adjusting the costs between these two cities.
(v) New air pollution equipment for the LA plant costs $ 7 million in 2003 (not required in the Gary plant).
(vi) The contingency cost due to the inclement weather delay will be reduced by the amount of 2% of total construction cost because of the favorable climate in LA (compared to Gary). On the basis of the above conditions, estimate the order of magnitude for the new project.

8. (a) What is resource leveling? How resource leveling creates a smoother distribution of resource usage? Explain with a simple network. (12)

(b) Define GERT. How you will differentiate GERT from CPM or PERT? (08)

(c) A project consists of five activities: (15)

A. Excavating a trench
B. Laying a subbase of gravel
C. Laying a concrete pipe
D. Back filling
E. Compacting

Assume that the length of the pipe is 1000 m and that the productivity rates for the five activities are 100, 125, 75, 200 and 150 m per day, respectively. Draw the project diagram and give an explanation using LSM. Leave a minimum one day time buffer.

Khulna University of Engineering & Technology
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B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2019

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) Define contract and describe the elements of a contract. (15)
   (b) Define the organs of the state. What is common law? What are the sources of common law? (10)
   (c) Critically explain the importance of law of agency in the context of construction. (10)
2. (a) What are the three different types of harm arise from tort of negligence? (05)
   (b) Describe with example "the neighbor principle" under the law of tort. (10)
   (c) Write short note on: (i) Expressed terms (ii) Implied terms (iii) Innominate terms (iv) Exemption clause (v) Conditions and Warranties. (20)
3. (a) Define liquidated damage (LD). Describe with diagram the evolution of LD in a typical construction contract. (13)
   (b) Describe the situation when time is set at large during EOT claim. (10)
   (c) Write down the purposes and effect of LD clause in the context of construction. (12)
4. (a) Letter of intent is very dangerous for construction contract. Explain the reasoning. (05)
   (b) Briefly discuss the consequences when the contract admin certify that the works have been completed. (10)
   (c) Alternative dispute resolution (ADR) has a lot of advantages for construction sector – explain the statement with example. (10)
   (d) Under which situations the contractor may nevertheless be able to recover additional payment in the absence of "Condition Precedent"? (10)

Section – B

5. (a) Define addenda and modification. Write down the case study of Interstate General Government Contractors, Inc Vs. Stone about "Contra Proferentum". (12)
   (b) Write down the patent ambiguity rule. How will you set hierarchy among the contract documents in terms of conflicting among them? (08)
   (c) Concisely explain the problems that may arise with conflicted construction documents. (08)
   (d) Write down the advantages and disadvantages of Industry Standard Contract forms of construction. (07)

6. (a) What are promissory estoppels? Write down the case study of Fletcher Corp Vs. Pote Concrete Contractors, Inc about promissory estoppels.

(b) Compare the express and implied indemnity agreement with examples.

(c) Write down the A/E's liability for contract administration. (1

(d) What are the sources of constructive change? How the change work is performed? (07)

7. (a) What is accord and satisfaction? How can a contractor reserve his rights during construction change order? (13)

(b) List down the causes of contract termination by owner and contractor. (10)

(c) Write note on: (i) Commercial general liability insurance (ii) Builder's risk insurance (iii) Worker's compensation insurance. (12)

8. (a) What is mechanic's lien? What are the rules for claiming lien entitlement for services and materials? (10)

(b) Distinguish between Payment bond and Performance bond. (10)

(c) Write down the steps involved in a project close-out report. What is lessons learned session? Write down the importance and procedure to conduct a lessons learned session of a project. (15)

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B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2019

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) Define weather and climate. Distinguish between them. (07)

   (b) Explain the global wind patterns in different latitude of both north and south hemisphere with neat sketches. (14)

   (c) Write short notes on ITCZ. How does the earth keep thermal balance by equaling incoming and outgoing radiator? Show with diagram. (14)

2. (a) Characterize the pattern of composite or monsoon climate with example. (15)

   (b) Write down the name of atmospheric factors that influence the classification of tropical climate. Draw a climatic graph. (08)

   (c) Write short notes on: (i) Stevenson Screen (ii) Tropical Climate (iii) The Cosine Law. (12)

3. (a) A building need to be constructed as BECM Academic Complex in KUET. The site should be code based. Identify the local factors that are responsible for developing a site or micro-climate. (13)

   (b) Distinguish between microclimate and macroclimate. (07)

   (c) Analyze the factors that are responsible for deviation of urban climate and what could be the effects for deviation of urban climate. (15)

4. (a) Demonstrate the human in how many ways the earth's surface releases heat to the atmosphere? (15)

   (b) Outline the various subjective variables by which our thermal preferences are influenced. (05)

   (c) Write down the thermal balance equation. What happens if the equation is net equilibrium? (15)

Section – B

5. (a) Now a day, KUET Khulna region are warm humid and hot dry climate. In this climate how will you design a building considering the climatic comfort? (12)

   (b) Provide appropriate design solution with necessary sketches for a naturally ventilated building in composite monsoon climate. (08)

   (c) In which methods how can you measure temperature, humidity and air movement for designing a building in particular climate? Describe the methods of measuring climates. (12)

   (d) Why it is always colder higher altitudes? (03)

6. (a) Show the construction techniques and advantages of a brick wall using Rat-Trap bond. In monsoon climate which walls you can design with rat-trap bond to ensure thermal comfort? (25)

   (b) Explain "A green building is often not sustainable building; a sustainable building is a green building". (05)

   (c) What are the effective temperature and corrected effective temperature? Show the differences. What does it mean by 30 ^{0}c effective temperature? (05)

7. (a) Define Absolute Humidity (AH) and Saturation Point Humidity (SH). If the absolute vapour density is 12 g/m^3 at 23 ^{0}c compared to the saturation vapour density temperature of 17 g/m^3, then calculate the Relative Humidity (RH) with showing the relational equation among RH, AH and SH. (06)

   (b) In designing microclimate how different components of a building envelope are affected by the climatic factors? Show the design solution. (20)

   (c) Show the factors constituting regional climate and site climate. (09)

8. (a) How economic, social and environment analysis is used to evaluate a project as sustainable factors? Describe it with an example. (06)

   (b) The increasing number of humidity in the air depends on which incidents in a particular climate? Describe it with an example. (04)

   (c) Discuss about the temperature, humidity and air movement as the factors of climate comfort. (20)

   (d) Show the working mechanism of a tube house air ventilation. (05)

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B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2019

CE 3111

(Structural Analysis and Design-I)

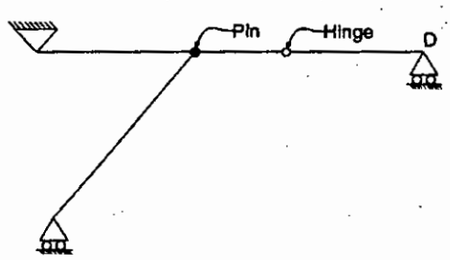
Full Marks: 210 Time: 3 hrs

N.B. i) Answer any three questions from each section in separate script.

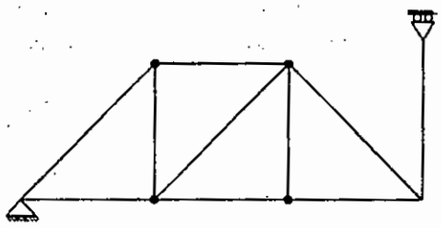
ii) Figures in the right margin indicate full marks.

Section – A

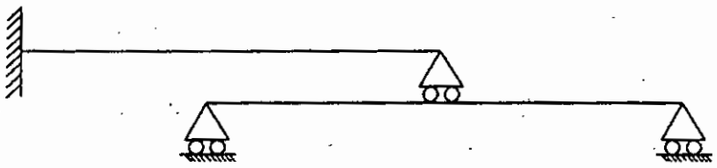
1. (a) Classify the structure as shown in figure below whether stable or unstable. Also, find the degree of statical indeterminacy. (06)



(i)



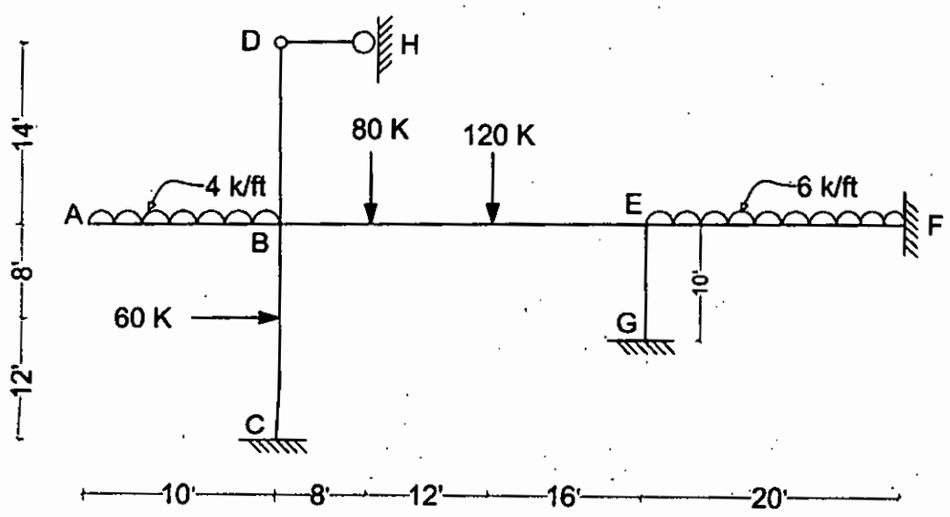
(ii)



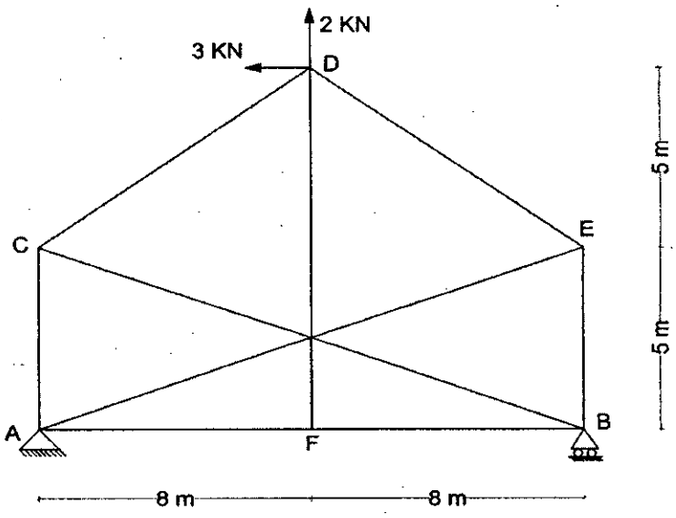
(iii)

(b) Determine the support reactions, and draw the shear force and bending moment diagrams of the frame as shown in figure below. The end moments are: (29)

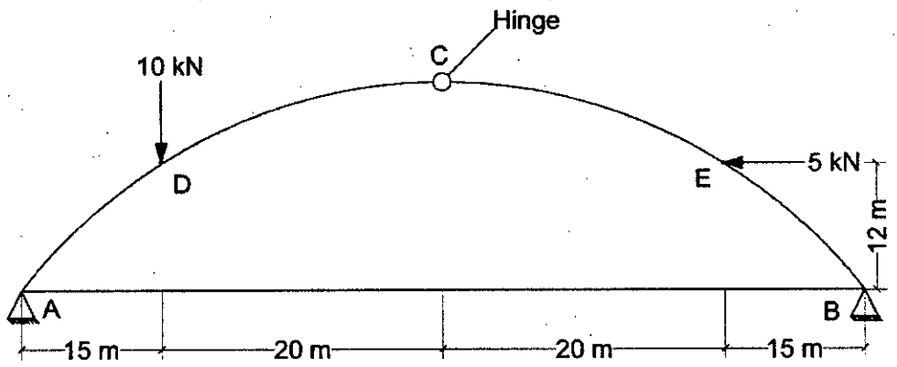
BD = +140 K '	EB = - 650 K '	CB = - 45 K '
BC = - 310 K '	EG = +180 K '	GE = - 90 K '
BE = - 650 K '	EF = - 470 K '	FE = - 66 K '



2. (a) Draw the typical shape of fink, saw tooth, and crescent trusses. Solve the compl truss by Henneberg method as shown in figure.



(b) Determine the bending moment @ 30 m from the right hand support of the three - hinged parabolic arch as shown in figure below. (15)



3. (a) Calculate the earthquake load at each floor level for a four storied residential reinforced concrete building from the following data: (17)
Height of each floor = 4 m
Plan area = 20 m x 30 m
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 = 2000 KN/floor

(b) Calculate design wind load @ each floor level for a four storied building as shown in figure by using following data: (18)

- Height of each floor = 3 m
- Height of ground floor = 3.5 m
- Exposure category = B
- Basic wind speed = 238 km/hr
- Pressure co-efficient = 1.5
- Building plan area = 20 m x 20 m

Height above ground level (m)	G_h/G_z	C_z
0-4.5	1.32	0.80
6	1.29	0.87
9	1.26	0.97
12	1.23	1.06
15	1.22	1.13

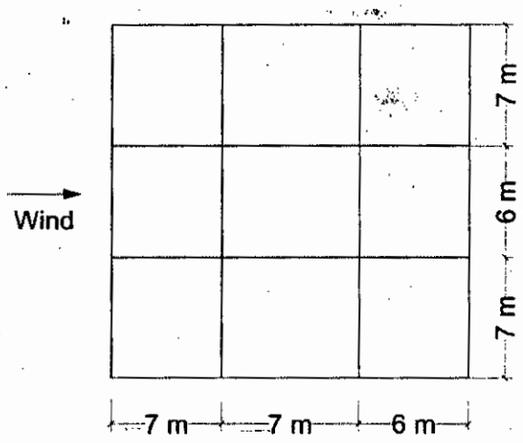
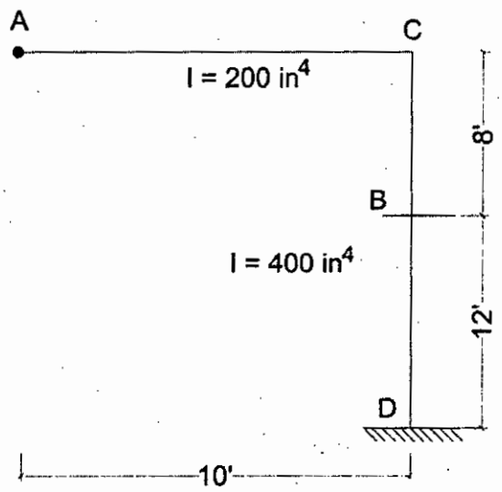
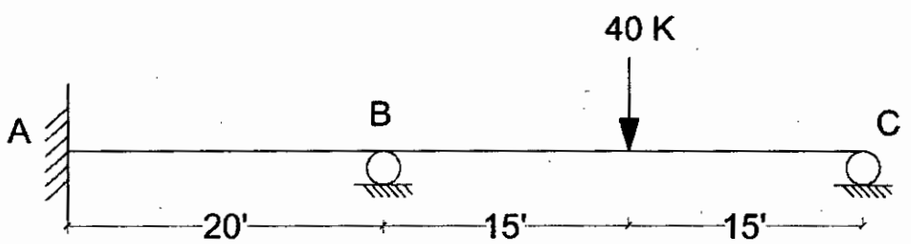


Fig: Plan of the building

4. (a) From the figure shown in below, find the rotational deflection of B due to 1 K force acting down at A. Also, find horizontal deflection of C due to a 1 K force acting down @ A. Consider, E = 30,000 K/in^2. (18)

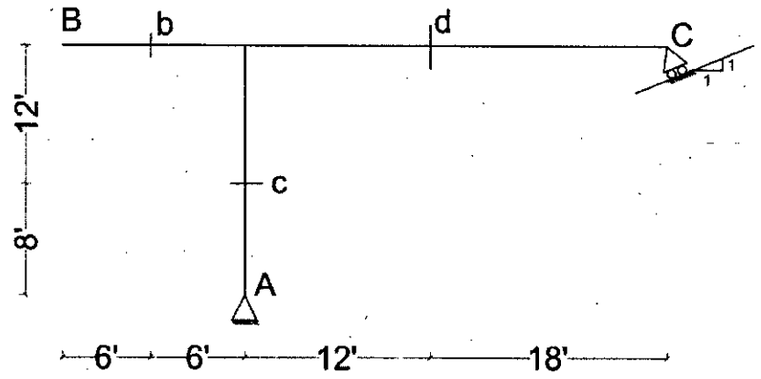


(b) Using conjugate beam method as shown in figure, find the followings: (17)
(i) the moments @ A and B
(ii) maximum deflection in the span BC
(iii) slope @ B.
Consider, I = 500 in^4 & E = 30000 K/in^2

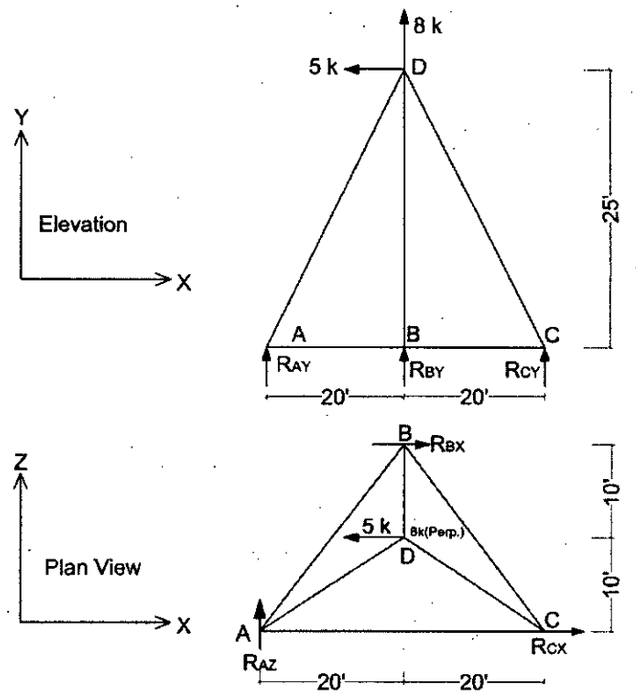


Section – B

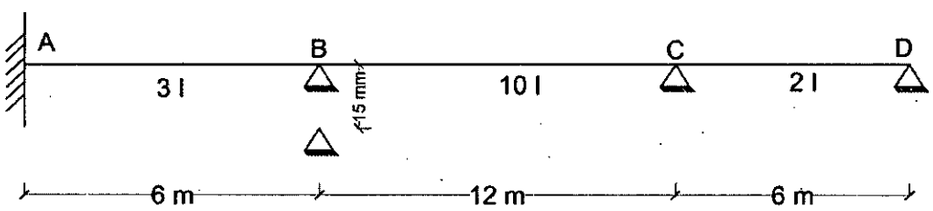
5. (a) Draw the following influence lines for the structure shown in fig. In all cases the unit load moves between B and C. (i) Vertical component of reaction A (ii) Shear and moment @ b (iii) Shear and moment @ C. (15)



(b) Find the reactions of space truss and also the bar forces as shown in figure below. (20)

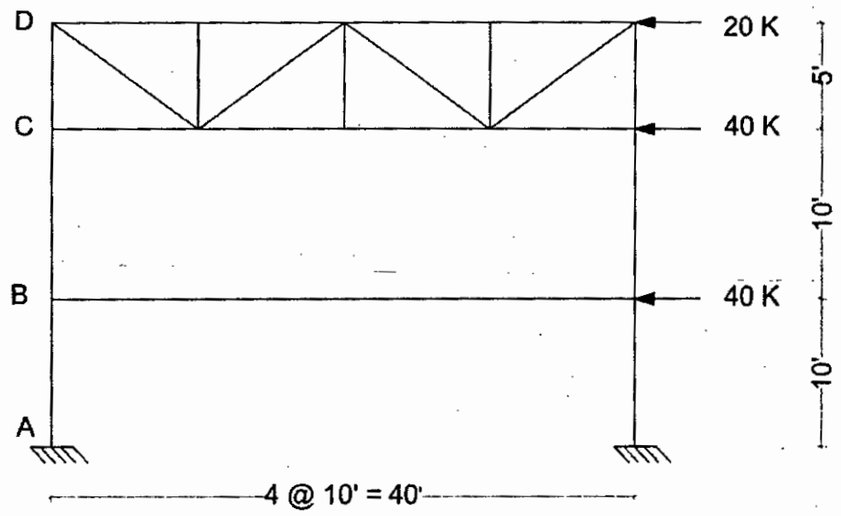


6. (a) Using the three moment equation, analyze the following continuous beam as shown in figure for a 15 mm settlement of support B. Assume, E = 200 x 10^6 KN/m^2 and I = 400 x 10^{-6} m^4. (20)

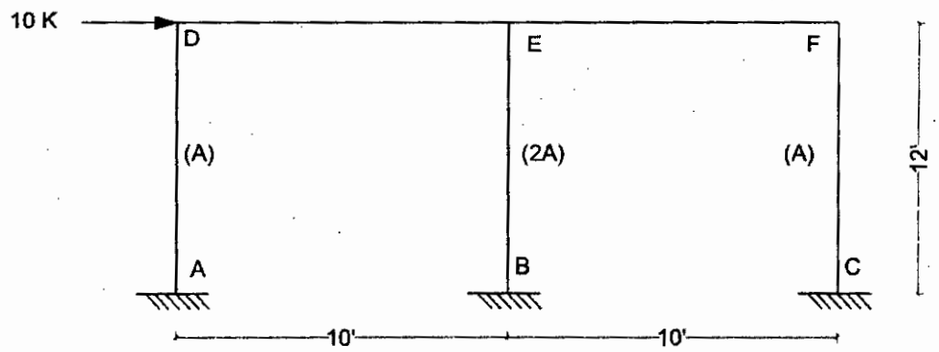


(b) A suspension cable is supported at two points A and B, A being one metre above B. The distance AB being 20 m. The cable is subjected to 4 loads of 2 KN, 4KN, 5 KN and 3 KN at distances of 4 m, 8 m, 12 m and 16 m respectively from A. Find the maximum tension in the cable, if the dip of the cable at point of application of first load is 1 m with respect to level at A. Find also the length of the cable. (15)

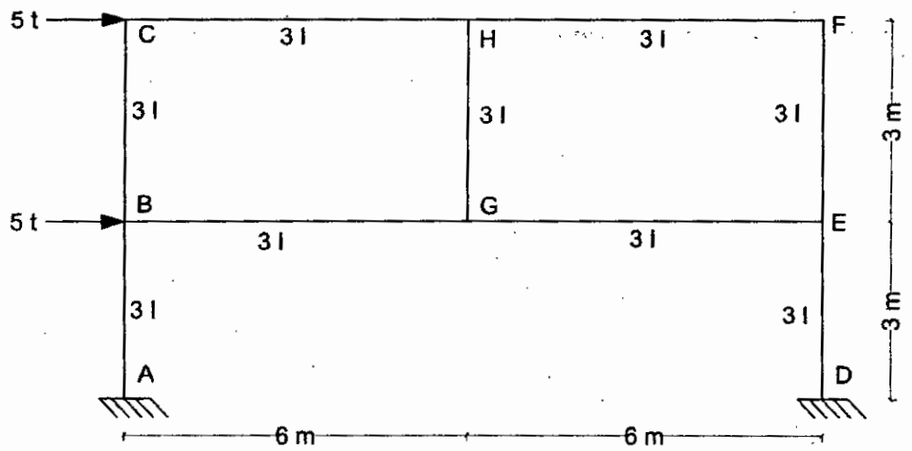
7. (a) Analyze and draw the SFD and BMD of ABCD column for the following structure. (15)



(b) Analyze the following frame by cantilever method. Area in parenthesis is shown in the figure for each column. (20)



8. Write down the assumptions made in the analysis of building frame subjected to lateral loads by portal method. Analyze the following building frame subjected to lateral loads by factor method. (35)



Khulna University of Engineering & Technology

Department of Building Engineering and Construction Management

B. Sc. Engineering 3rd Year 1st Term Regular Examination, 2019

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) Why does the ACI code specify that a certain minimum percentage of reinforcing be used in a beam design? (05)

   (b) Explain the purpose of the minimum cover requirements for reinforcing specified by the ACI code. (05)

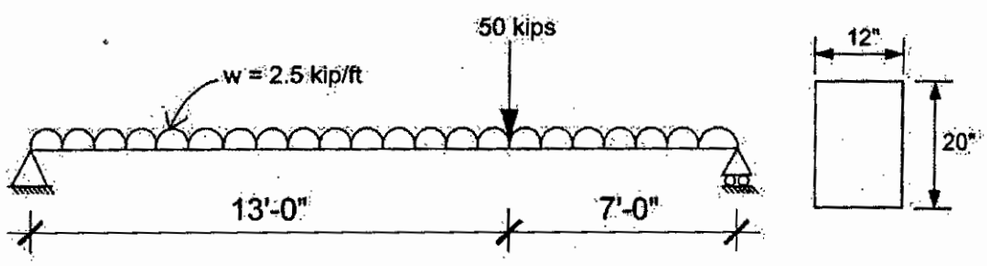
   (c) A rectangular beam that must carry a service live load of 2.5 kips/ft and a calculated dead load of 1.20 kips/ft on a 22 ft simple span is limited in cross section for architectural reasons to 12 inch width and 25 inch total depth. It is reinforced for compression bars in one row, the center of which is 2.5 inch from upper surface of the beam, and for tension with bars in two rows, the center of the lowers row being 2.5 inch above the lower surface of the beam. If f_y = 60,000 psi and f_c' = 3500 psi, what steel areas must be provided? Design the beam by WSD method and show reinforcement details. (25)

2. (a) Design a lintel over a window opening 6 ft wide. The wall is 10 inch thick. The height of the wall above the lintel is 6 ft. Use, f_c' = 3000 psi and f_y = 60,000 psi. (15)

   (b) A tensile reinforced beam has width b = 12 inch and effective depth d = 20 inch. If f_c' = 3500 psi and f_y = 60,000 psi, find the nominal flexural strength, M_n for the reinforcements (i) 3 - # 8 bars and (ii) 3 - # 10 bars. Follow WSD method. (20)

3. (a) Explain the fundamental propositions on which the mechanics of reinforced concrete is based. (07)

   (b) A simply supported beam of 20 ft span length is shown in figure below. Determine the maximum moment that can be utilized in design area of steel and actual concrete size of the beam. If f_c' = 3500 psi and f_y = 60,000 psi, design the beam by USD method and show reinforcement details. (28)



4. (a) Under what condition part of a slab is included to form a T-beam? Distinguish between real T-beam and false T-beam. How can you design a false T-beam? (10)

   (b) An isolated T- beam is to be designed to carry a uniformly distributed load on a 20 ft simple span. The total ultimate moment at mid-span due to all loads is 6000 kips-inch. Concrete dimensions as governed by web shear and clearance conditions are b = 45 inch, bw = 10 inch, and d = 20 inch. What tensile reinforcement is required at mid-span, if f_c' = 3500 psi and f_y = 60,000 psi? Design the beam by USD method and show reinforcement details. (25)

Section – B

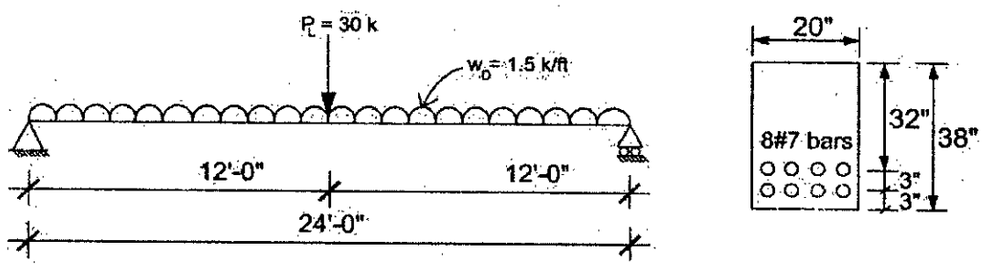
5. (a) Why is it difficult to calculate actual bond stresses? Why do the cover of bars and the spacing of those bars affect required development length? (07)

   (b) What is tension and compression splices? Show the dimensional details of hooks used for main reinforcement according to the ACI code. (09)

   (c) Calculate the required embedment length of the 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 = 16 in., $A_{s\ required}$ = 1.8 in^2. 3 #7 bars top reinforcement in a single layer in a beam with No. 3 stirrups. f'_c = 3000 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. (19)

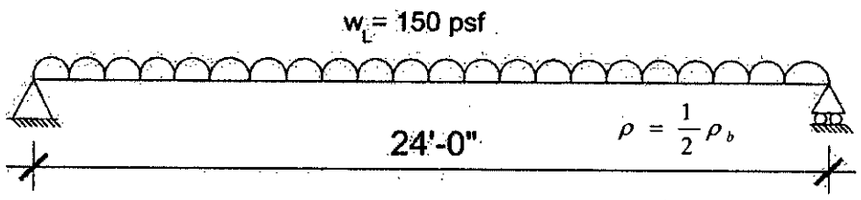
6. (a) The ACI code provides the following limiting shear values for members subject only to shear and flexure: $2\sqrt{f'_c}$, $4\sqrt{f'_c}$ and $8\sqrt{f'_c}$. What is the significance of each of these limits? (06)

   (b) For the beam and loads shown in figure, select stirrups spacing if f'_c = 4000 psi normal weight concrete and f_{yt} = 60,000 psi. The dead load shown includes beam weights. Assume # 3 stirrups and use USD method. (29)



7. (a) Why temperature and shrinkage reinforcements are provided in the design of one-way slab? Explain briefly. (07)

   (b) Design an interior one-way slab for the situations shown in figure. Concrete weight = 150 lb/ft^3, f_y = 60,000 psi and f'_c = 4000 psi. The only dead load is the weight of the slab. Show the reinforcement detailing in a neat sketch. Use USD method. (28)



8. (a) What is the importance of corner reinforcement in slab? Explain with simple sketch. (05)

   (b) Design the corner panel of a two-way slab of a university residential student hall, having panel size of 24 ft x 24 ft center to center, where width of supporting beams are 12 inch on all sides. A service live load of 85 psf is distributed over the roof surface and a floor finish of 25 psf is added to the self weight of slab. (30)

   Use f'_c = 3 ksi and f_y = 60 ksi. Show the reinforcement detailing of slab in a neat sketch. Use USD method. ACI moment co-efficients are given below:

   Ca (-ve) = Cb (-ve) = 0.05, *Ca (+ve) DL = Cb (+ve) DL* = 0.027
   Ca (+ve) LL = Cb (+ve) LL = 0.032