

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 4thYear 2ndTerm Regular Examination, 2017
BECM 4201
(Quality Management in Construction)

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) Explain quality by five principal approaches. Draw the "Construction Project Trilogy". (12)
(b) Define Quality Control (QC) and Quality Assurance (QA). Explain quality control process stated by Gyna with neat sketch. (08)
(c) What are the best practices in quality control process? Describe different methods of quality control. (15)
2. (a) Summarize the philosophies developed by Crosby, Deming and Juran. (12)
(b) Illustrate Deming's "PDCA" cycle. Explain clearly the procedure to use "PDCA" cycle. At which circumstances the "PDCA" cycle can be used? (10)
(c) Portrait Ishikawa's fishbone diagram with appropriate example. Describe the procedure in details to use fishbone diagram (13)
3. (a) What is meant by Total Quality Management (TQM)? Outline the cultural changes required to meet TQM. (10)
(b) What are the strategic implications of TQM? Show the basic components of TQM by diagram. (10)
(c) What is six sigma quality management? Draw the six sigma roadmap. How six sigma quality management help organization to achieve customer satisfaction? (15)
4. (a) Write short note on (i)ISO (ii) IQMS (iii) OHSAS (09)
(b) Explain ISO certification process with diagram. Write down the importance and advantages of ISO certification. (13)
(c) State the benefits of implementing Integrated Quality System (IQMS). Draw the logic flow diagram for development of IQMS. (13)

Section – B

5. (a) Define quality in construction. Describe the elements of quality in construction. (12)
(b) What is quality control? Describe the stages when the inspection and testing carried out to ensure quality compliances. (15)
(c) Outline the sequences of works to ensure the quality in a typical construction site. (08)
6. (a) Why quality audit is needed to ensure the quality in construction? (05)
(b) Define quality assessment and describe the quality assessment categories. (15)
(c) Classify the types of quality audit. Outline a typical audit procedure. (15)

7. (a) Write the grounds for project manager to reject contractor's works in accordance with the Bangladesh standard tender document (national). (08)
- (b) Briefly describe the contents of a typical construction progress report. (15)
- (c) Describe the procedure of remedial works in accordance with clauses 28 of the Bangladesh standard tender document (national). (12)
8. (a) What is cost of poor quality? Graphically represent the effect of having cost of quality. (08)
- (b) As a client's QA/QC manager, what are the items need to be checked prior to takeover a floor and window in a new build residential building project? (15)
- (c) The cost that a builder spends for a new build condominium project in Singapore is given below. Categorize the quality cost from data below: (12)

S/N	Item	Cost(\$)
01	Rectification	1000
02	System breakdown	800
03	Repair	500
04	Maintenance	200
05	On-site material test	300
06	Off-site material test	400
07	Pre-checklist inspection	200
08	Training	500
09	Work procedure	200
10	Method statement	900
11	Warranty	1500
12	Corrective action	2000

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2017
BECM 4203
(Information Technology in Construction)

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 technology? Describe the contribution of technology to address human need and wants. (10)
- (b) Define Information Technology (IT). Write down the role and scope of IT in construction. (10)
- (c) Describe the main possible ICT development trends for transformation of construction and real estate sector. (15)

2. (a) Write down the name of data that can be extracted from a construction site of high-rise building project. (15)
- (b) Mention the names of Geo-spatial and imaging technologies for construction site data acquisition. (08)
- (c) What are the advantages and limitations of Multimedia tools and Email services for data acquisition? (12)

3. (a) What are the benefits of publishing open data? (05)
- (b) Write down the managerial information required for asset information requirements. (07)
- (c) What is SMART building? What are the technologies should include in SMART building? (10)
- (d) Show the conceptual IT architecture to support visual management and lean construction scenarios on construction sites. (13)

4. Write short notes on (any five): (35)
 - (i) Contour Crafting
 - (ii) Augmented Reality
 - (iii) Mobile Computing
 - (iv) Internet of Things (IoT)
 - (v) Radio Frequency Identification (RFID)
 - (vi) Big Data for Buildings
 - (vii) SMART Construction
 - (viii) Electronic Document Management System

Section – B

5. (a) Define Building Information Modeling (BIM)? Describe the evolution of BIM. (10)
(b) List down the basic works that various stakeholders are able to do by BIM. (07)
(c) Write down the attributes & properties of BIM models. (08)
(d) What is deliverable? List down typical BIM deliverables. (10)
6. (a) Write down the names of 3D, 4D, 5D, 6D and 7D features of BIM. (25)
(b) Briefly discuss the 4D features of BIM. (10)
7. (a) Describe the new approaches to construction safety innovation? (10)
(b) BIM technology can be used for risk management. Describe the process. (10)
(c) "The adoption of BIM is essential for KUET" - explain briefly. (05)
(d) Write short notes on: (i) Level of Details (LOD) (ii) Parametric Modeling (iii) Interoperability (iv) BIM Collaboration and (v) IFC. (10)
8. (a) Write down at least seven (7) BIM tools for sustainability. (07)
(b) Describe the process of conceptual whole building energy simulation. (13)
(c) What is sustainable design? How BIM technology aid to achieve sustainability? (15)
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Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2017
BECM 4205
(Real Estate Development)

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) Explain the role of the developers in Real Estate Development. (10)
(b) What are the three fundamental ways that can be used to understand the term real estate? (13)
(c) Draw the concept of Real Estate Administrative Model (REAM) in Brief. (12)
2. (a) What is meant by the term "Improvement to the land" and "Improvement on the land" in relation to real estate development? (10)
(b) What are the primary characteristics of real estate assets that distinguish them from others? (10)
(c) What are the fundamental ways to use the ~~world~~^{word} real estate in empirical and professional field? How in real estate market activity influenced by the activities and conditions that take place in three sectors of a market economy? (15)
3. (a) Mention the steps that a Real Estate Housing Development Project follows. (10)
(b) How does economic base multiplier influence the real estate sectors of a city? "The size of an economic base multiplier depends on the amount of leakages from the local economy"- Explain the meaning of leakages in this case. (15)
(c) How does each of these affect the slope of a bid-rent curve: Faster travel, more frequent trips, more commuters, higher- density housing and high hourly wage rate? (10)
4. (a) Why is it important to consider the economic base of a city in real estate decisions? (05)
(b) In the hypothetical situation of simple bid rent theory there are considered 318 households. Among them, there are 26 doctors, and 292 other commuters of which 80 walk and 212 drive. Calculate and draw the bid-rent curve of each group. Assume necessary data for each group. (15)
(c) Define consumer surplus and market surplus. Quantities demanded and supplied are expressed as $Q_d = 80 - 5P$ and $Q_s = -24 + 8P$ respectively. Find out the market surplus from these equations with necessary diagrams. (15)

Section – B

- 5 (a) True real estate decisions are about acquiring, financing, using, improving and disposing of actual real estate assets. Explain the statement. (10)

- (b) Discuss about the idea of investment in context of real estate with necessary examples. (10)
- (c) Write and explain the four combinations of real estate investment risk with examples. (15)
- 6 (a) Explain the concept of property cycle in real estate market research with examples. (10)
- (b) When will the downturn actually occur in real estate market? Explain with supply and demand curve. How a developer will survive during a market downturn? (20)
- (c) Draw the anatomy of real estate cycle. (05)
- 7 (a) Using a simplified model show the relation between land use and geographical location in market research. (10)
- (b) Mention some key components for a good investment decision in context of Bangladesh. (10)
- (c) Differentiate forecasting and Portfolio analysis tools of real estate market research with examples. (15)
- 8 (a) If you are to estimate a land price in Fulbarigate (beside the main road) list the major factors that would affect the land price. Justify the factors according to the socio-economic context of Bangladesh. Express the price function through hedonic assumptions. (20)
- (b) How land price is defined by hedonic assumptions? Explain the difference between land cost estimation of hedonic assumptions and conventional methods. (15)
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Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 4th Year 2nd Term, Regular Examination, 2017
BECM 4247
(Contemporary Building 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) What does it mean by contemporary building design? What are the basic differences between modern and contemporary building design considerations? (15)
- (b) What are the characteristics of high-tech building design? Explain them with the examples of high tech building designers and their works. (20)
2. (a) Write down the advantages and disadvantages of Diagrid structure. (15)
- (b) Briefly discuss about the components of Diagrid structural system with neat sketches. (20)
3. (a) Explain the mechanisms of framed tube and braced tube structures. Which one is better between this two structural systems for gaining height in designing a high-rise building? Explain. (15)
- (b) Describe the concepts and characteristics of tube in tube structure system. Discuss about the “Millennium Tower” as an example of tube in tube structure system. (10)
- (c) Bundle tube is the best structure system for gaining height in designing high-rise building – How? (10)
4. (a) What are the purposes of advanced building materials? (25)
- (b) Describe some advanced building materials as the example of contemporary building materials. Show their use in building. (10)

Section – B

5. (a) Define sustainable architecture. Discuss about – “Sustainability is an attitude in contemporary building design”. (10)
- (b) What are the principles of sustainable architecture? (15)
- (c) As a building engineer describe the importance of sustainability. (10)
6. (a) The birth of modern architecture came from a realization that the future should not hinge the past – explain briefly. (15)
- (b) What were the driving forces behind the Arts and Crafts movement? (10)
- (c) Write down your understanding about the International Style. (10)

7. (a) What is Ecological Approaches in building design? (10)
- (b) Write down the principles of organic building design and green architecture. (15)
- (c) "Expression of Building Form, Structural Integrity and User's Need" among these three factors, as a building designer on which things you should give more importance? (10)
8. (a) Define De-constructivism. Name the pioneering architects of De-constructivism. (15)
- (b) How critics often define De-constructivist architects? (10)
- (c) Why computer aided software is very much essential for this type of building construction? (10)
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Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2017
CE 4221
(Design of Steel Structures)

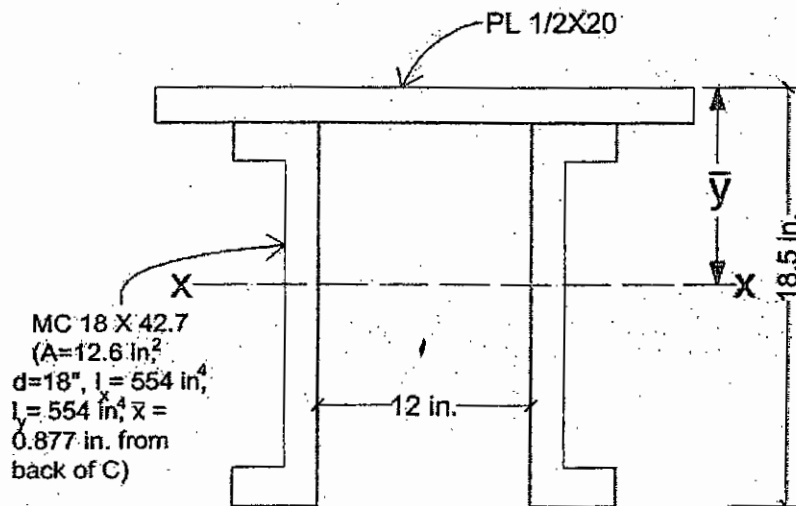
Full Marks: 210

Time: 3 hrs

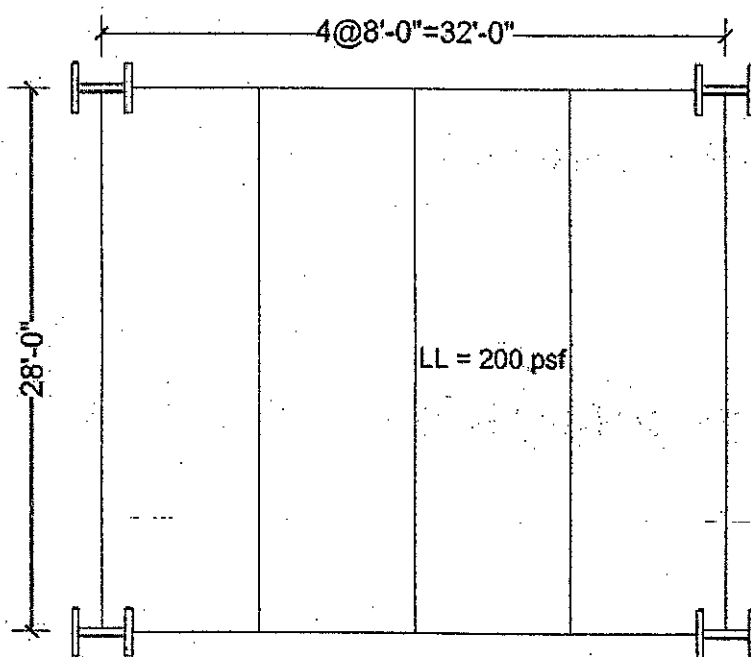
- N.B.**
- i) Answer any three questions from each section in separate script.
 - ii) Figures in the right margin indicate full marks.
 - iii) Assume reasonable value for any missing data
 - iv) Necessary table will be supplied

Section – A

1. (a) What are the applications of steel structures? Write down the advantages and disadvantages of steel structures. (10)
- (b) Write short notes on structural steel properties (i) Ductility (ii) Residual stress (iii) Proof stress (iv) Fatigue (08)
- (c) Determine the LRFD design strength and the ASD allowable strength for the axially loaded column shown in figure if $KL = 19$ ft and 50 ksi steel is used. (17)

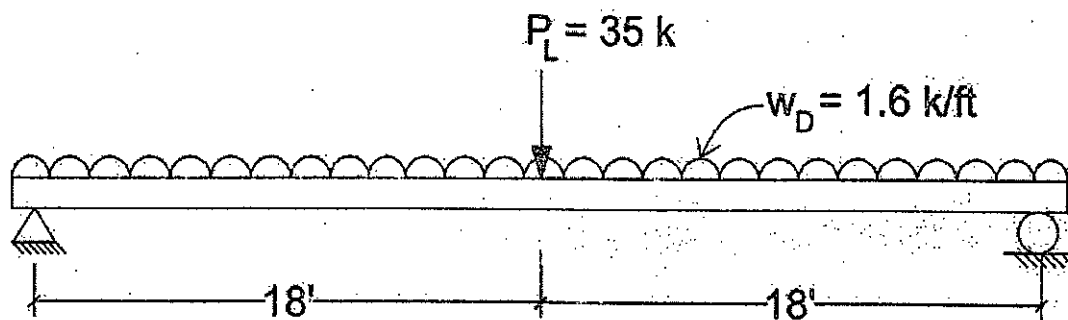


2. (a) Design a square column consisting of four angles to support an axial load of 1600kN. The effective length of column is 10 m. (15)
- (b) A column is subjected to an axial load of 500 kn. The beam connected to the flange of a column, has an eccentric load of 100 kN and the beam connected to the web of a column has an eccentric load of 50 kN. If the effective length of the column is 4 meters and only rolled H-sections are available. Design the column. (20)
3. (a) What is Euler buckling stress of a column? State the limitations of Euler's formula in a column. (07)
- (b) A 24 ft column in a braced frame building is to be built into a wall in such a manner that it will be continuously braced in its weak axis direction but not its strong axis direction. If the member is to consist of 50 ksi steel and is assumed to have fixed ends, select the lightest satisfactory W10 section available using the AISC specifications. Loads are $P_D = 220$ k and $P_L = 370$ k. Solve by LRFD and ASD methods. (28)
4. (a) Why shear connectors are provided in the steel concrete composite slab and beam? (04)
- (b) Design an interior composite beam for the floor whose plan shown in figure assuming the beam is to be constructed without temporary shoring. Use 50 ksi steel, $f'_c = 4$ ksi ($n = 8$), a 4-in. slab, and use LRFD method. (31)

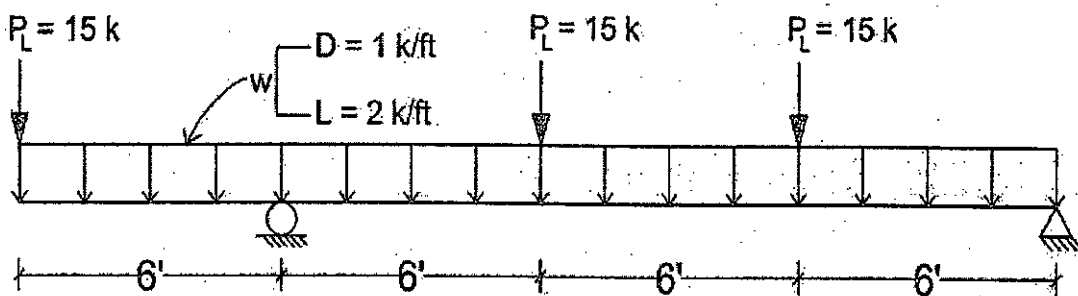


Section - B

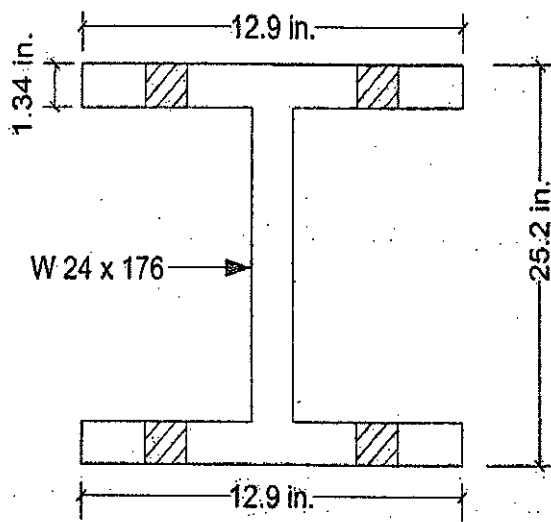
5. (a) Select a beam section by using both the LRFD and ASD methods for the span and loading shown in figure. Assuming full lateral support is provided for the compression flange by the floor slab above (that is, $L_b = 0$) and $F_y = 50$ ksi. (15)



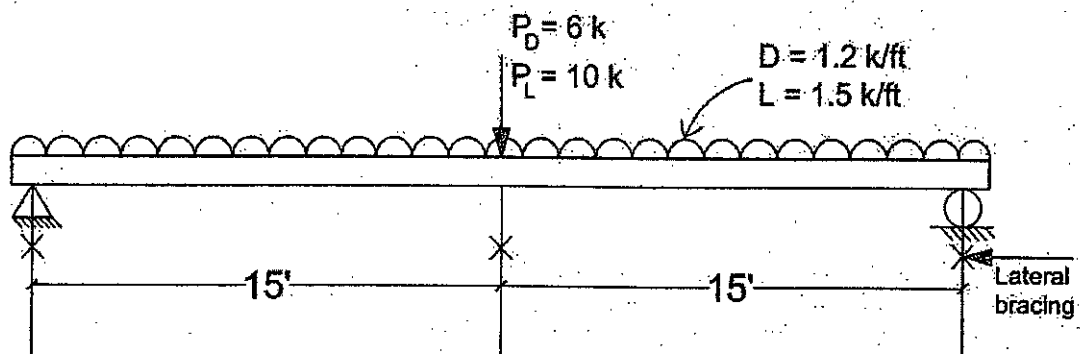
- (b) Using both LRFD and ASD, select the most economical sections with $F_y = 50$ ksi, (20) unless otherwise specified, and assuming full lateral bracing for the compression flanges as shown in figure. Working or service loads are given for each case, and beam weight is not included.



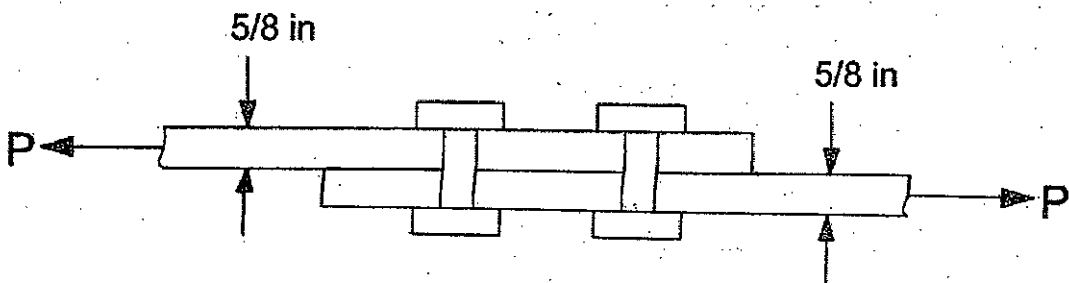
6. (a) Determine $\phi_b M_n$ and M_n / Ω_b for the W 24 X 176 ($F_y = 50$ ksi, $F_u = 60$ ksi) beam (15) shown in figure for the following situations:
- Using AISC specification and assuming two lines of 1-in bolts in standard hole in each flange.
 - Using the AISC specification and assuming four lines of 1-in bolts in standard hole in each flange.



- (b) Select the beam section by using 50 ksi steel and both the LRFD and ASD methods. Select the lightest available section for the situation shown in figure. Bracing is provided only at the ends and at mid span. (20)



7. (a) A double angel tie is 200mm X 100mm X 12mm (short legs back to back) of a roof truss in connected to the same side of a gusset, with rivets 20 mm in diameter, such that each angel is reduced in section by one rivet hole only. Determine the tensile strength of the member. Stitch rivets have been provided at suitable spacing. (15)
- (b) Design a 9-ft single angel tension member to support a dead tensile working load of 30 k and live tensile working load of 40 k. The member is to be connected to one leg only with 7/8-in bolts (at least four in a line 3 in a on center). Assume that only one bolt is to be located at any one cross section. Use A36 steel with $F_y = 36$ ksi and $F_u = 58$ ksi. (20)
8. (a) Write down the advantages of bolted connections. (06)
- (b) For the lap joint shown in figure, the axial service loads are $P_D = 27.5$ k and $P_L = 40$ k. Determine the number of 1-in A325 slip-critical bolts in standard-size holes needed for the limit state of the slip if the faying surface is class A. The edge distance is 1.75 in., and the c. to c. spacing of the bolts is 3 in. $F_y = 50$ ksi, $F_u = 65$ ksi. (22)



- (c) Describe briefly the failure of bolted joints. (07)

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
 B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2017
CE 4223
 (Precast and Prestressed Concrete)

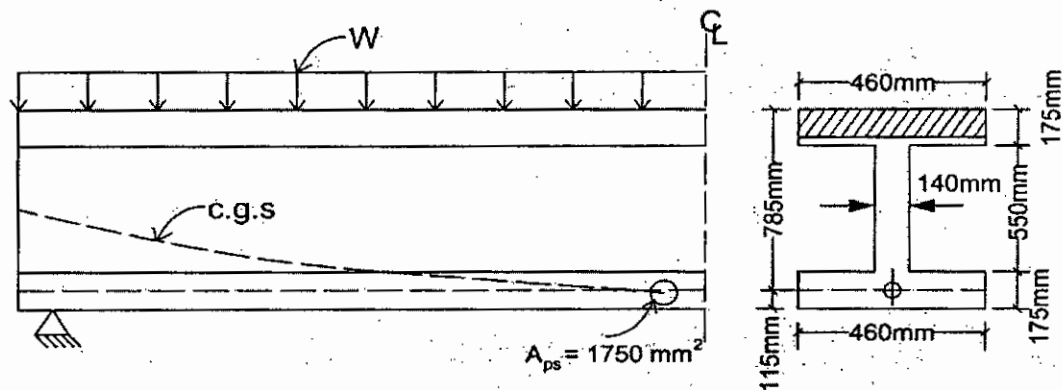
Full Marks: 210

Time: 3 hrs

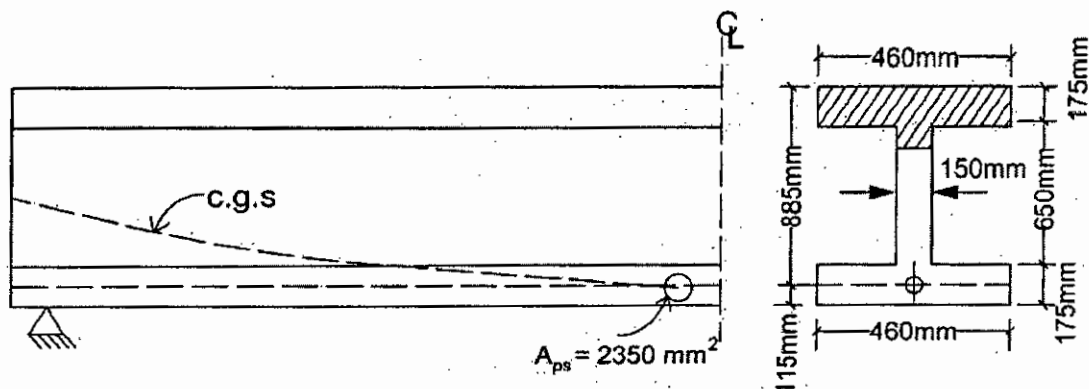
- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable value for any missing data

Section – A

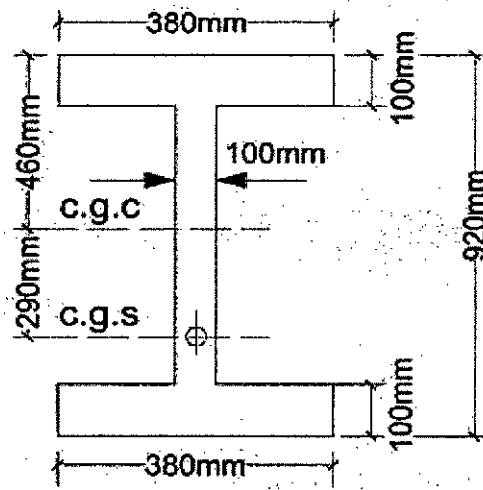
1. (a) Prove that $M_u = \phi \left[A_{ps} f_{ps} \left(d - \frac{a}{2} \right) \right]$ (15)
- (b) An I-shaped beam is prestressed with $A_{ps} = 1750 \text{ mm}^2$ as prestressing steel with an effective stress f_{se} of 1100 MPa. The c.g.s of the strands which supply the prestress is 115 mm above the bottom of the beam as shown in figure along with the shape of the concrete cross section. Material properties are: $f_{pu} = 1860 \text{ MPa}$, and $f'_c = 48 \text{ MPa}$. Find the ultimate resisting moment of the section for design following the ACI code. (20)



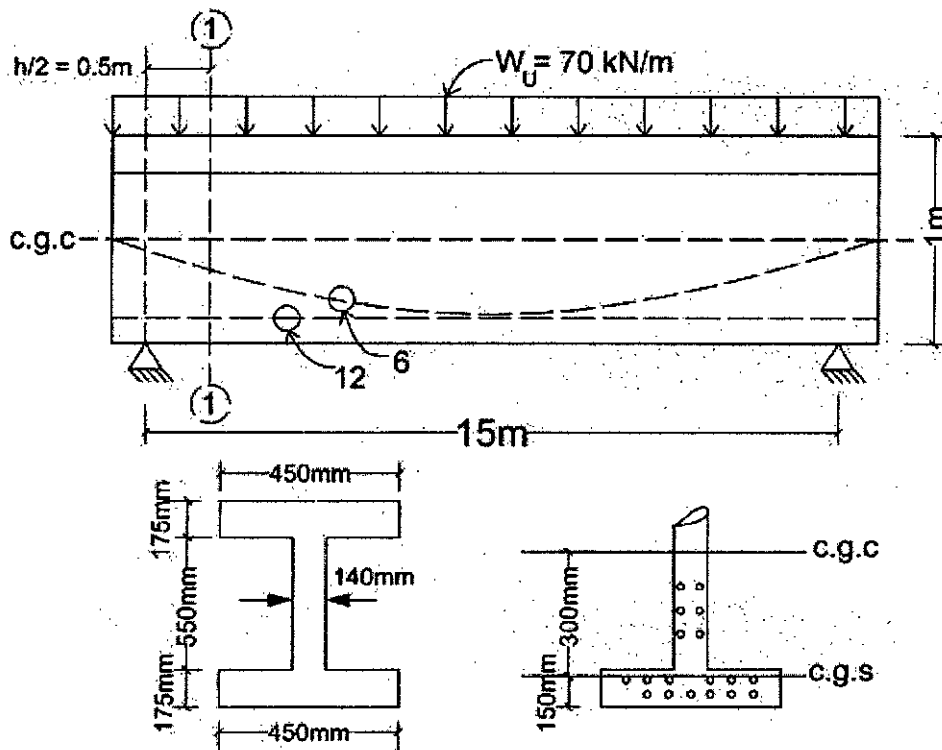
2. (a) What are the limitations of method for determining ultimate flexural strength? (05)
- (b) An I-shaped beam is prestressed with $A_{ps} = 2350 \text{ mm}^2$ as prestressing steel with an effective stress f_{se} of 1100 MPa. The c.g.s of the strands which supply the prestress is 115 mm above the bottom of the beam as shown in figure along with the shape of the concrete cross section. Material properties are: $f_{pu} = 1960 \text{ MPa}$, and $f'_c = 48 \text{ MPa}$. Find the ultimate resisting moment of the section for design following the ACI code. (30)



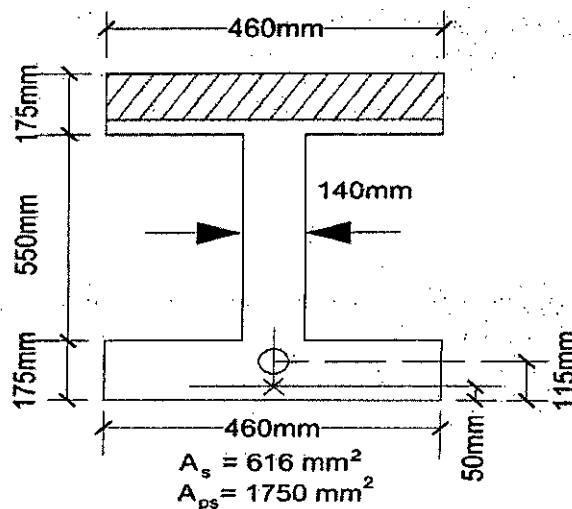
3. (a) Make a final design for the preliminary section as shown in figure, allowing $f_b = -12.5 \text{ MPa}$, $f_o = 1035 \text{ MPa}$. Other given values were: $M_T = 435 \text{ kN-m}$; $M_G = 55 \text{ kN-m}$; $f_t = -11 \text{ MPa}$; $f_{se} = 860 \text{ MPa}$ and $F = 826 \text{ kN}$. (15)



- (b) Check the shear strength for the beam shown in figure at section 1-1 which is $h/2$ (20) from the support. Given that this section is adequate for $W_u = 70 \text{ kN/m}$, $A = 23.45 \times 10^4 \text{ mm}^2$, $I = 2.304 \times 10^{10} \text{ mm}^4$, $S = 5.12 \times 10^7 \text{ mm}^3$ and $f'_c = 49 \text{ MPa}$.

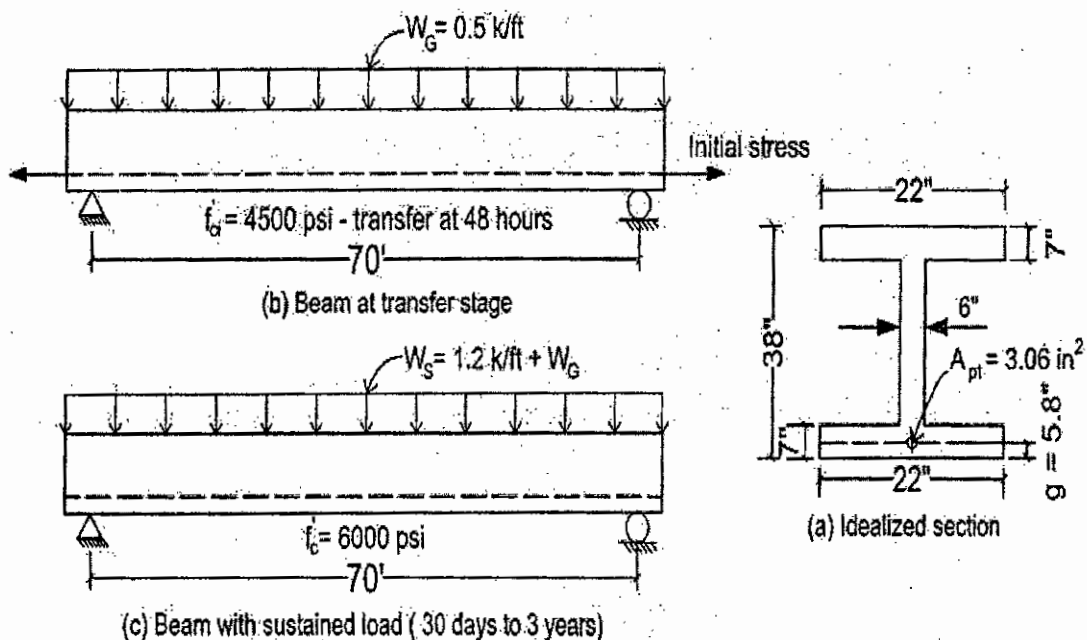


4. (a) Briefly describe the different types of shear cracking in prestressed beam. (05)
- (b) An I-shaped beam is prestressed with unbounded tendons shown in figure. How much bonded reinforcement must be provided to satisfy ACI code requirements? (30) What is the estimated ultimate moment capacity of the section with $A_{ps} = 1750 \text{ mm}^2$ and minimum bonded reinforcement supplied with deformed bars having $f_y = 415 \text{ MPa}$? Assume $f_{se} = 1100 \text{ MPa}$ for the unbounded tendons, $f_{py} = 1585 \text{ MPa}$ and $f'_c = 48 \text{ MPa}$.



Section – B

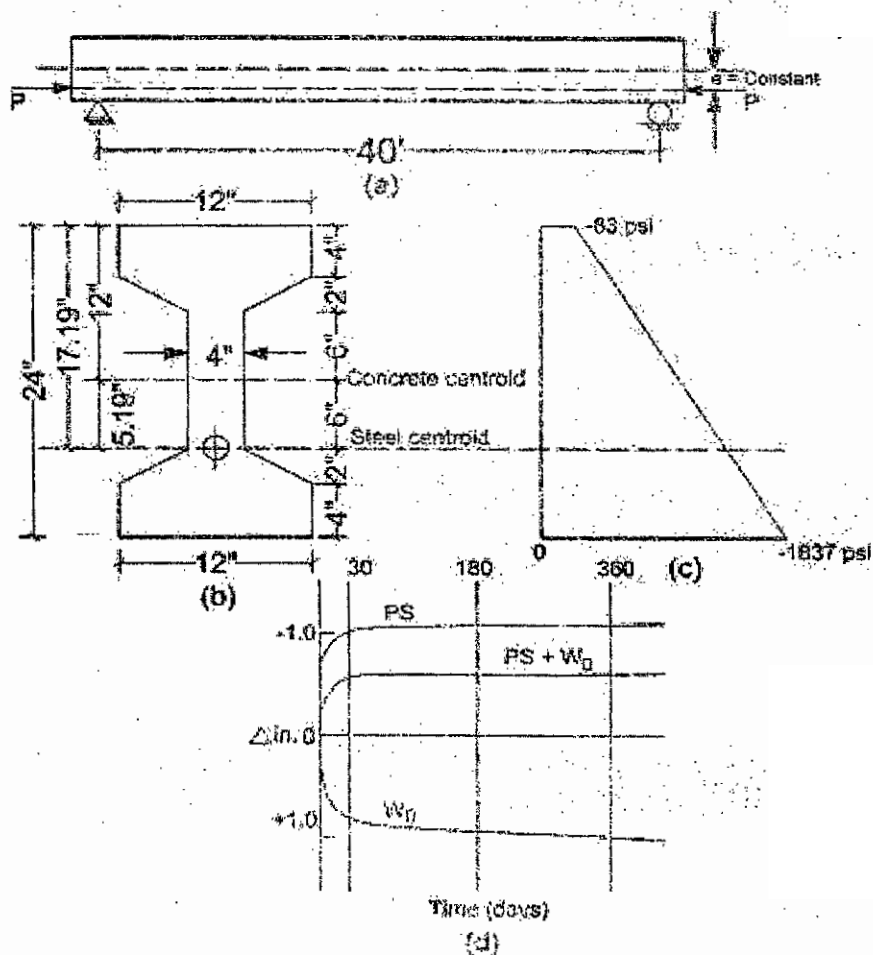
5. (a) Write down the advantages and disadvantages of prestressing. What are the uses of prestressing? (11)
- (b) Describe the post-tensioning and pretensioning methods of prestressing. (12)
- (c) A preston cable 20 m long is to be tensioned from one end to an initial prestress of 1100 MPa immediately after transfer. Assume that there is no slack in the cable, that the shrinkage of concrete is 0.00025 at time of transfer, and that the average compression in concrete is 6.0 MPa along the length of the tendon. $E_c = 26,000$ MPa and $E_s = 200,000$ MPa. Compute the length of shims required, neglecting any elastic shortening of the shims and any friction along the tendon. (12)
6. (a) Briefly describe the following terms that are related with loss of prestressing (i) Elastic shortening (ii) Relaxation of steel (iii) Frictional losses. (12)
- (b) The change of prestress force with time for the pretensioned prestressed concrete beam shown in figure. The normal weight concrete beam has only its own weight $w_G = 0.50$ k/ft acting at transfer of prestress which occurs approximately 48 hours after initially stressing the tendons to 202.5 ksi in the prestressing bed. For 30 days it will assume the beam carries only $w_G = 0.50$ k/ft on a simply supported 70 ft span. Additional superimposed load $w_S = 1.2$ k/ft is added to the beam when erected at 30 days and is sustained for three years or more on the simple beam spanning 70 ft. Assume the following material properties: $f'_{ci} = 4500$ psi, $f'_c = 6000$ psi, normal weight concrete (Type III cement, steam-cured concrete, 75% relative humidity), stress-relieved $\frac{1}{2}$ in. diameter strands with $f_{pu} = 270$ ksi, $A_{ps} = 3.06$ in², $J = 0.15$, $K_{re} = 20,000$ psi, $C = 1.45$, $E_{ci} = 3.824 \times 10^3$ ksi, $e = 13.2$ in. Estimate total losses due to prestressing by using ACI-ASCE committee method. (23)



7. Calculate the midspan deflection of the 40-ft span I-beam shown in figure at age 0, 30, 180, and 360 days, using step by step method. The member, originally studied in connection with elastic stress analysis, is to carry its own weight of 183 plf and will be subjected to a service live load of 550 plf. The following data are provided: (35)

$$P_i = 169,000 \text{ lb}, A_p = 0.96 \text{ in}^2, f_y = 210,000 \text{ psi}, f_{pi} = 175,000 \text{ psi}, A_c = 176 \text{ in}^2, I_c = 12,000 \text{ in}^4, r^2 = 68.2 \text{ in}^2, E_c = 4,030,000 \text{ psi}, C_u = 2.35, \epsilon_{sh,u} = 800 \times 10^{-6}$$

The member will be constructed of normal density concrete, moist-cured, and will be prestressed at age seven days. E_c will be taken as constant.



8. (a) What are the assumptions are usually made to cambers due to prestress? (08)
- (b) A two-way prestressed concrete slab, measuring 60 X 120 ft overall, is to be provided to carry a tennis court over an underground parking facility. Support will be provided by masonry walls on the perimeter, and steel framing along the interior column lines, as shown in figure. An asphalt court surface 2-in. thick, weighing 25 psf, will be provided. (a) Design the left corner slab for a balanced load consisting of the self-weight of the slab and the asphalt topping. Also determine the required slab thickness, prestressing force and number and spacing of 1/2-in. diameter Grade 270 unbonded post-tensioning tendons. Concrete strengths $f'_{cr} = 3500$ psi, $f'_c = 5,000$ psi and $E_c = 3.6 \times 10^6$ psi (b) Check concrete flexural stresses in the fully loaded stage assuming live load of 100 psf. (27)

$$C_a(-ve) = 0.076, C_b(-ve) = 0.024, C_{a,DL}(+ve) = 0.043, C_{b,DL}(+ve) = 0.013, C_{a,LL}(+ve) = 0.052, C_{b,LL}(+ve) = 0.016$$

