



PROGRAM : **B.ENG TECH: CIVIL ENGINEERING**

SUBJECT : **REINFORCED CONCRETE DESIGN III**

CODE : **RCDCIA3**

DATE : WINTER EXAMINATION
13 MAY 2019

DURATION : (SESSION 1) 08:00 – 12:00

WEIGHT : 40 : 60

TOTAL MARKS : 103

EXAMINER : MR C. BRUWER

MODERATOR : MR. G. ROBERTS

NUMBER OF PAGES : 4 PAGES

INSTRUCTIONS : THIS IS A PARTLY OPEN BOOK EXAMINATION, THE FOLLOWING IS ALLOWED:
2 PAGES OF STUDENT'S OWN NOTES
SANS 0100 CODE
COLUMN DESIGN GRAPHS
NO TABLES OR COPIES FROM ANY TEXTBOOK ALLOWED

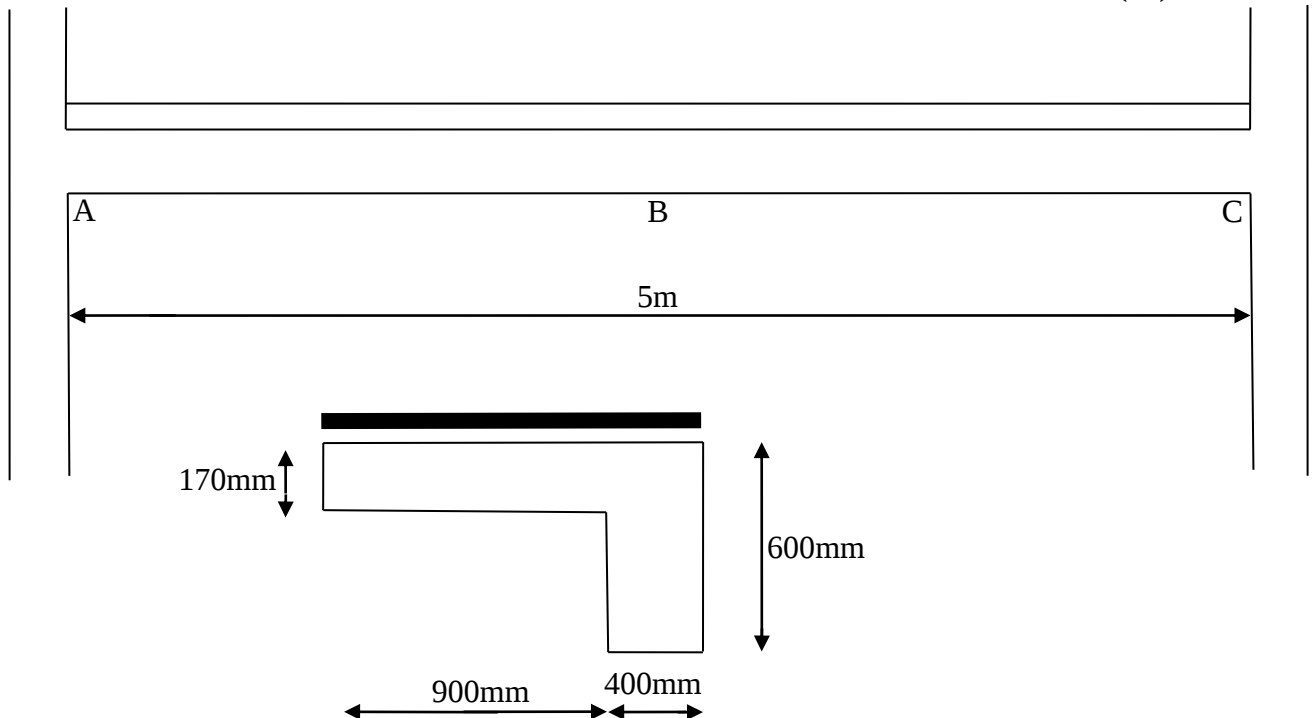
: PLEASE ANSWER ALL THE QUESTIONS
PLEASE NUMBER ALL THE QUESTIONS

REQUIREMENTS : PROGRAMABLE POCKET CALCULATORS ALLOWED.

QUESTION 1

Design the concrete beam indicated in the sketch below by:

- 1.1 Determine the ultimate loading (2)
 - 1.2 Calculate the max moments, max shear force and max torsional force (5)
- Calculate the number and diameter of reinforcement bars required for:
- 1.3 Negative bending moment (11)
 - 1.4 Positive bending moment (10)
 - 1.5 Shear force (6)
 - 1.6 Torsional force (2)
 - 1.7 Combined shear and torsion (9)
- (45)



Loads:

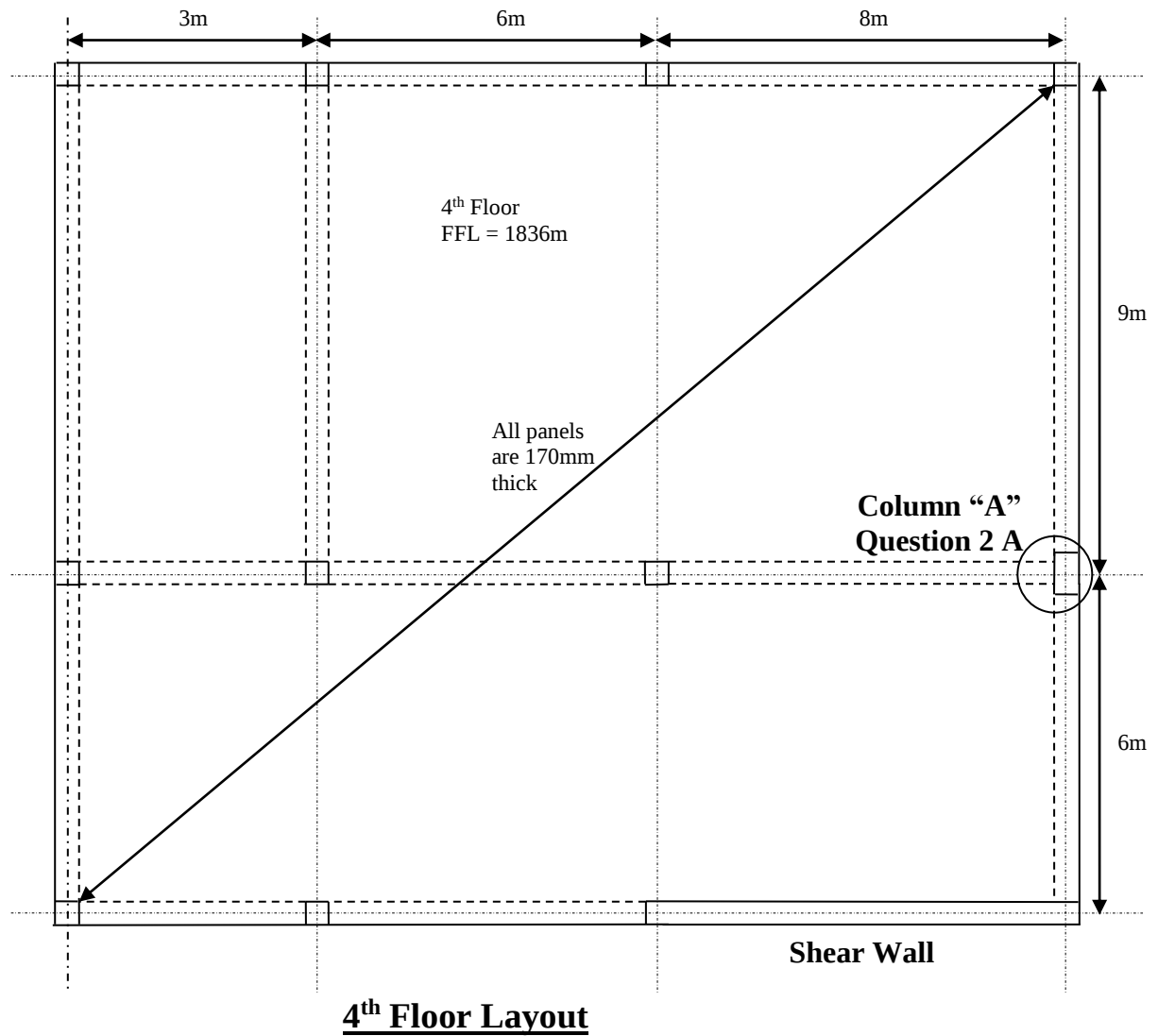
- W_n (UDL) A-C: Nominal permanent = 35kN/m^2
Nominal imposed = 18kN/m^2
- Take the own weight of the beam into consideration (own weight of the beam not included in the nominal permanent load of 35kN/m^2)

General Information:

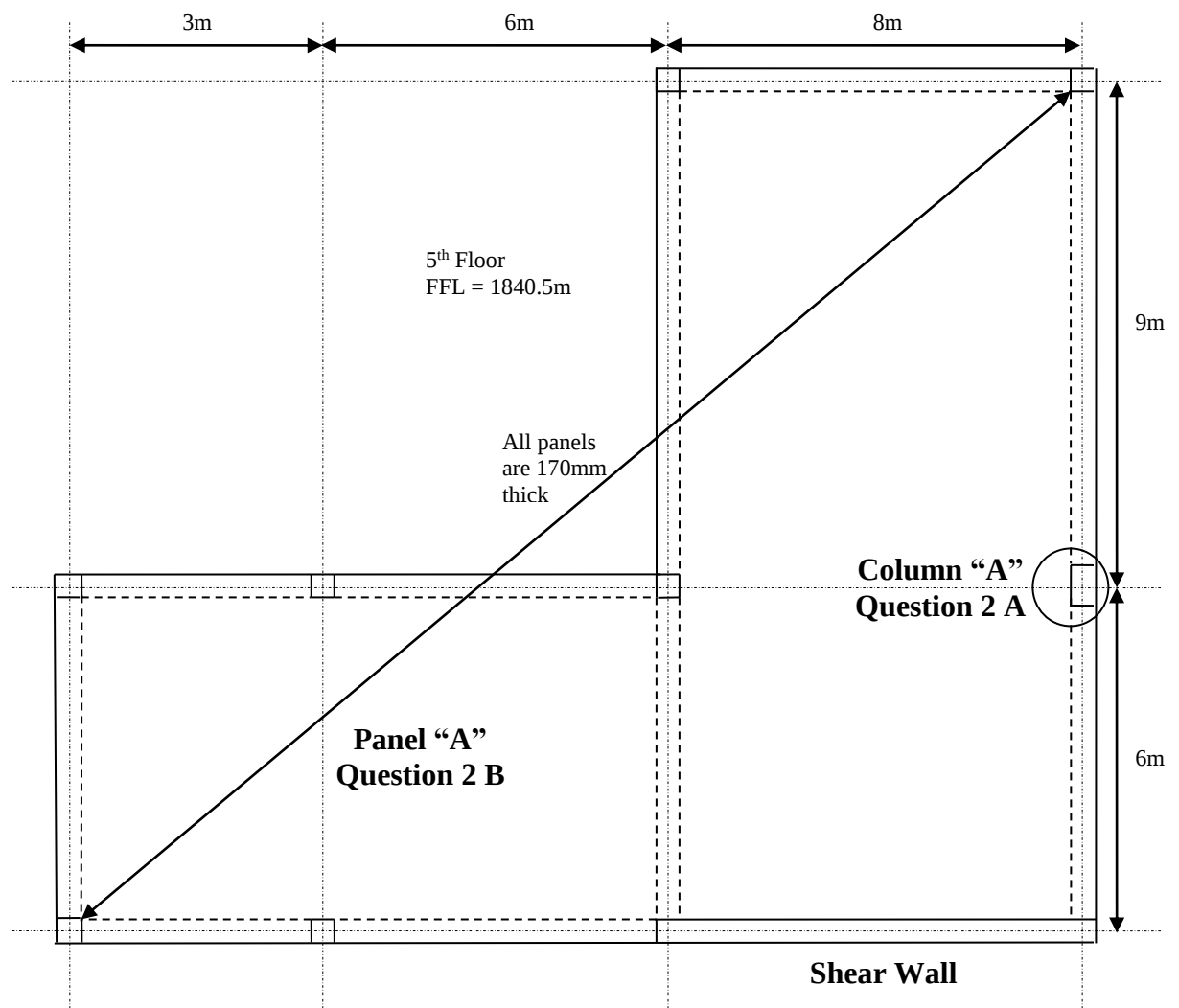
- The full cross-section of the beam will resist the generated bending moment (both positive and negative),
- The rectangular beam (400mm x 600mm) will resist the generated shear and torsional forces.
- Beam A-C is fixed to the columns at A and C, take the moments as:
 - $M_A = M_C = -W_u L^2 / 12$ (W_u in kN/m)
 - $M_B = W_u L^2 / 24$ (W_u in kN/m)
- 25/19 Concrete with mild exposure conditions
- For initial calculations try: Y25 bars in tension (for both pos and neg BM)
R12 stirrups

QUESTION 2

From the sketch below answer Questions 2A and 2B.



All beams are 220 x 450mm deep



5th Floor Layout

All beams are 220 x 450mm deep

QUESTION 2 A

Design all the required reinforcement for Column “A” (400mm x 220mm) in a ten (10) storey building between the 4th and 5th floor of a building as indicated in the sketches of Question 2.
(45)

Ultimate Axial load = 850kN

Ultimate moments about the x-axis:

- Top = 21kNm
- Bottom = -29kNm

Ultimate moments about the y-axis:

- Top = 25kNm
- Bottom = 9kNm

General information:

- 30/19 Concrete with mild exposure conditions
- For initial calculations try: Y20 vertical bars
R8 stirrups

QUESTION 2 A

Determine only the moments (do not calculate reinforcement bar areas) for the solid slab, “Panel A” on a ten (10) storey building.

- Positive moments in both span direction/s
- Negative moment in both span direction/s
- Vertical shear

(13)

General information:

- All beams are 220mm wide x 400mm deep
- For initial calculations try Y12 bars
- Concrete = 25/19 with mild exposure conditions
- All dimensions are from center line to center line
- Panel A would be used as a public assembly area with fixed individual seating 3.5kN/m².
- A screed 30mm thick, 2050kg/m³ unit weight, will be cast on the concrete floor
- Take own weight of the slab into account

Total [103]