PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: CIVIL*
SUBJECT	:	**REINFORCED CONCRETE AND MASONRY DESIGN III**
CODE	:	**RCM31-1**
DATE	:	WINTER SSA EXAMINATION 2015 23 JULY 2015
DURATION	:	(SESSION 1) 08:00 - 11:00
WEIGHT	:	40 : 60
TOTAL MARKS	:	158

EXAMINER	:	MR C. BRUWER
MODERATOR	:	MR. B. RAATH
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS	:	THIS IS A PARTLY OPEN BOOK EXAMINATION: 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
REQUIREMENTS	:	PROGRAMABLE POCKET CALCULATORS ALLOWED.

QUESTION 1

Design the beam in the sketch below by determining the required reinforcement due to flexure and shear.

(30)

Loads:
- Nominal live Point Load at B = 180kN/m
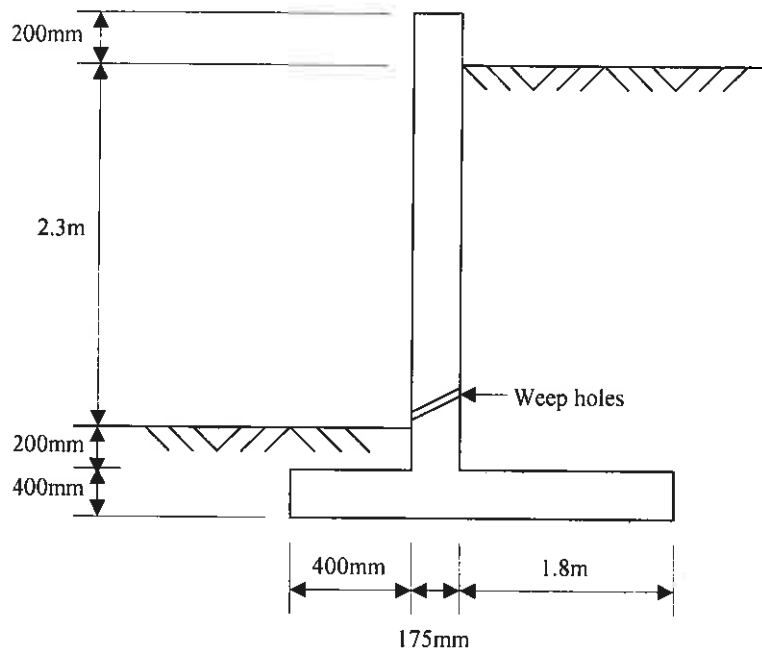- Take the own weight of the beam into consideration.

General Information:
- 30/19 Concrete with moderate exposure conditions
- For initial calculations use:
  - Y25 bars as tension reinforcement, 4 bars extend to the end of the beam
  - Y16 bars as compression reinforcement
  - R12 bars as shear reinforcement

QUESTION 2

Design the retaining wall in the sketch below which retains 2.3m soil by:
- Determine if it is safe for overturning
- Determine if it is safe for sliding
- Determine if the pressure exerted on the supporting soil is within the bearing capacity
- Determine the ultimate moment and ultimate shear forces and calculate the reinforcement for the:
    - Stem
    - Heel
    - Toe   (82)

Design Data:

The soil behind the retaining wall will carry a nominal live load of $3kN/m^2$.
Concrete is 30/19 with severe exposure conditions.
Use a safety factor for overturning and sliding as 1.5.
Soil Properties:
- Bearing capacity = 125kPa
- Density = $1680kg/m^3$
- Internal angle of friction = $23.5°$
- Sliding friction coefficient = 0.4
ULS Safety Factors:
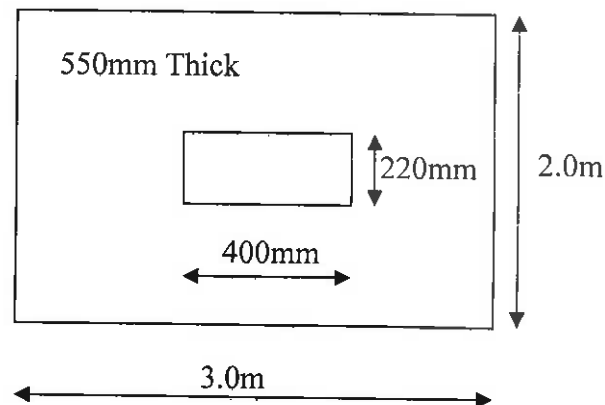- Concrete = 1.2
- Backfill = 1.4
- Surcharge = 1.6
Assume Y16 bars in the footing and wall.

QUESTION 3

Design the reinforcement for a 2m x 3m base as indicated in the figure below by:
- Determine if the maximum soil pressure is exceeded
- Determine the maximum bending moment in both directions
- Determine the flexural reinforcement
- Check if the vertical shear is within limits
- Check if the punching shear is within limits   (46)

The base is covered with 500mm (deep) soil.
The unit weight of the soil is $18kN/m^3$
Concrete = 30/19 with severe exposure conditions.
Ground bearing capacity = 320kPa
Loads:
- Nominal dead point load   = 480kN
- Nominal live point load   = 610kN
- Nominal dead M_x = 41kNm
- Nominal live M_x = 49kNm

Assume Y16 bars in both directions.

TOTAL = 158