Engineering Mechanics

Final paper

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Class ID: 16115

Section: A

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Department: Civil Engineering

Semester: 2

Dated: 27-06-2020

Signature

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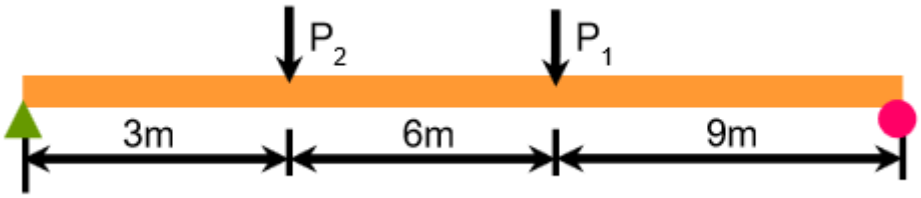
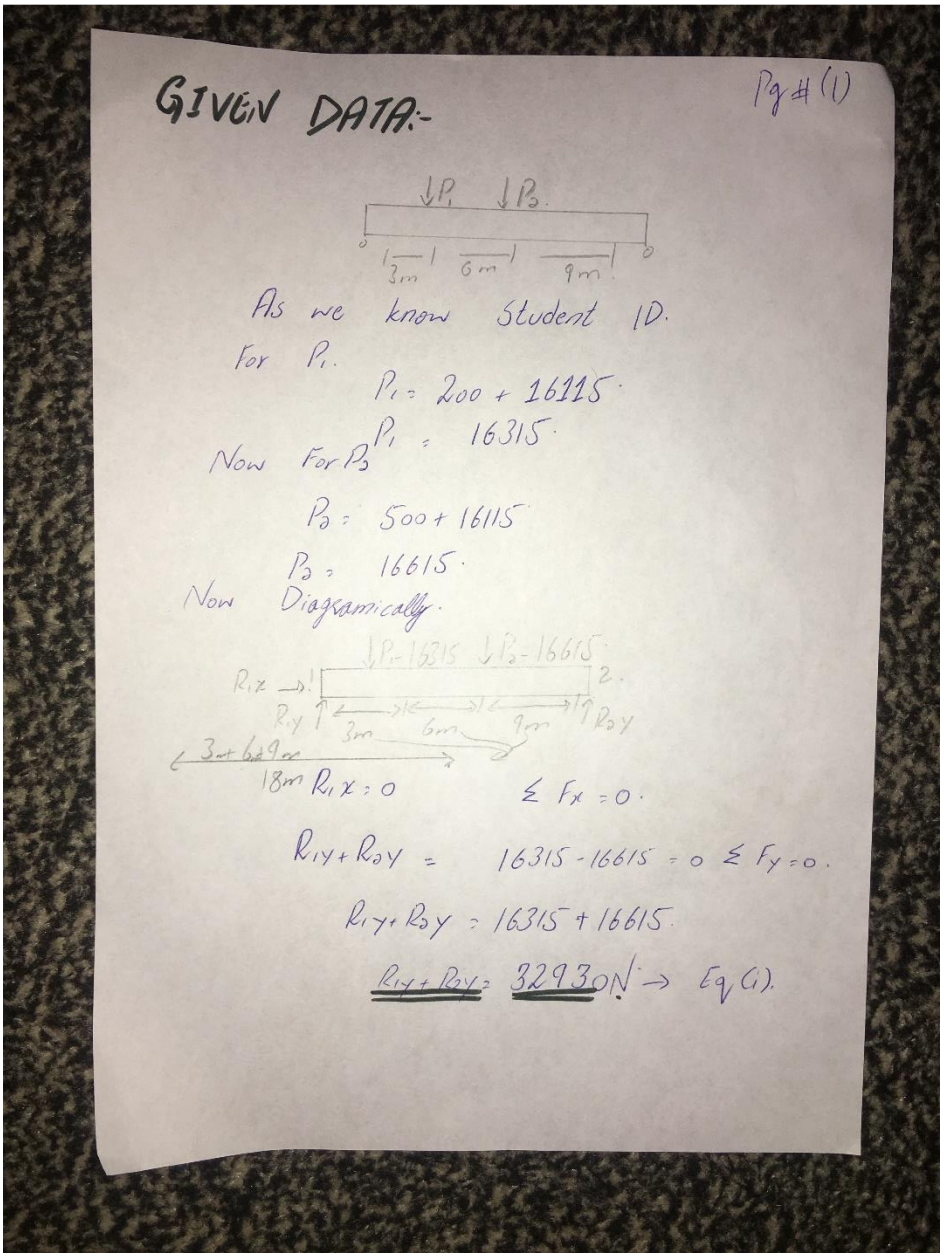
IQRA NATIONAL UNIVERSITY

HAYATABAD, PESHAWAR

Q1: Find the support reactions, Show all your calculations.

(P1 = 200 + Student ID No) , (P2 = 500 + Student ID No)





$$R_{1y} = \left[\frac{(16315 \times 9) + (16615 \times 15)}{18}\right]$$ Pg# (2)

$$R_{1y} = \frac{146835 + 249225}{18}$$

$$R_{1y} = \frac{396060}{18}$$

$R_{1y} = 22003.3\,N \rightarrow$ eq(2)

Put eq(2) in eq(1), we get

$R_{1y} + R_{2y} = 32930$

$22003.3 + R_{2y} = 32930$

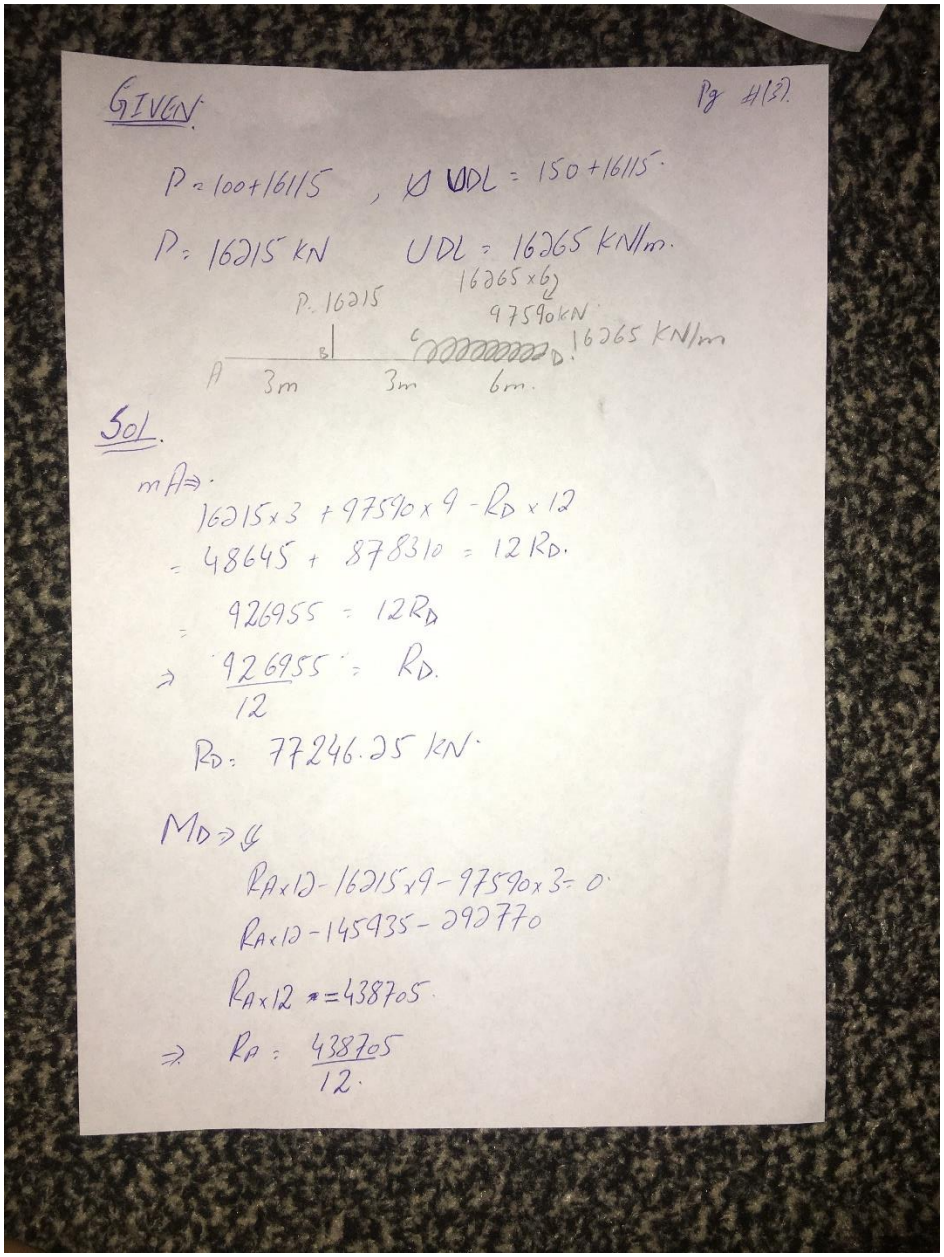
$\Rightarrow R_{2y} = 32930 - 22003.3$

$R_{2y} = 10926.7\,N$

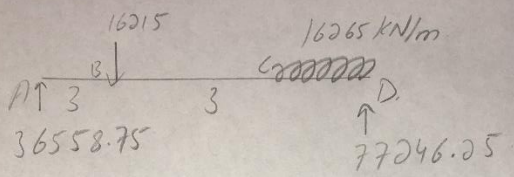
$R_{1x} = 0N$, $R_{1y} = 22003.3\,N$, $R_{2y} = 10926.7N$

Q2: Draw the neat shear force diagram, Show all your calculations.

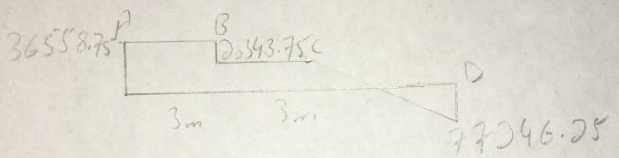
(P = 100 + Student ID No) , (UDL = 150 + Student ID No)



$R_A = 36558.75 kN$

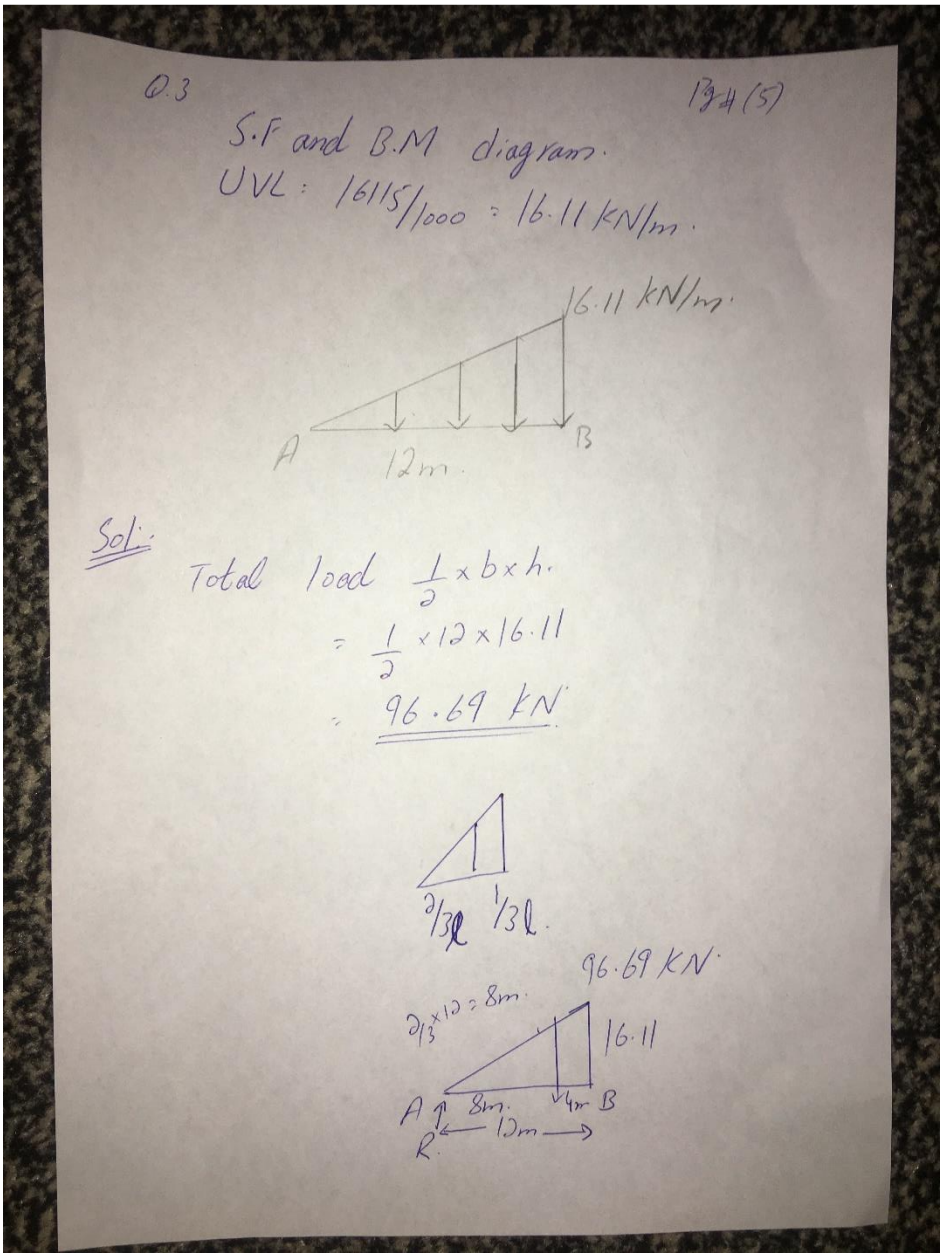


Shear force diagram.



Q3: Draw the neat shear force and bending moment diagrams, Show all your calculations.

(UVL = Student ID No /1000)



$M_A \Rightarrow$

$96.69 \times 8 - R_B \times 12 = 0$

$773.52 = 12 R_B$.

$\Rightarrow \frac{773.52}{12} = R_B$.

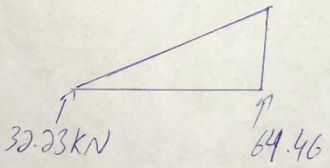
$R_B = 64.46\,kN$.

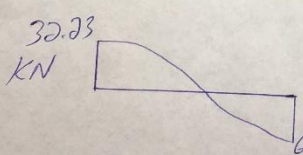
$M_B \Rightarrow$.

$R_A \times 12 = 96.69 \times 4$.

$12 R_A = 386.76$.

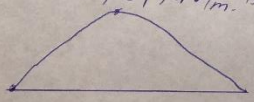
$\Rightarrow R_A = 32.23\,kN$.



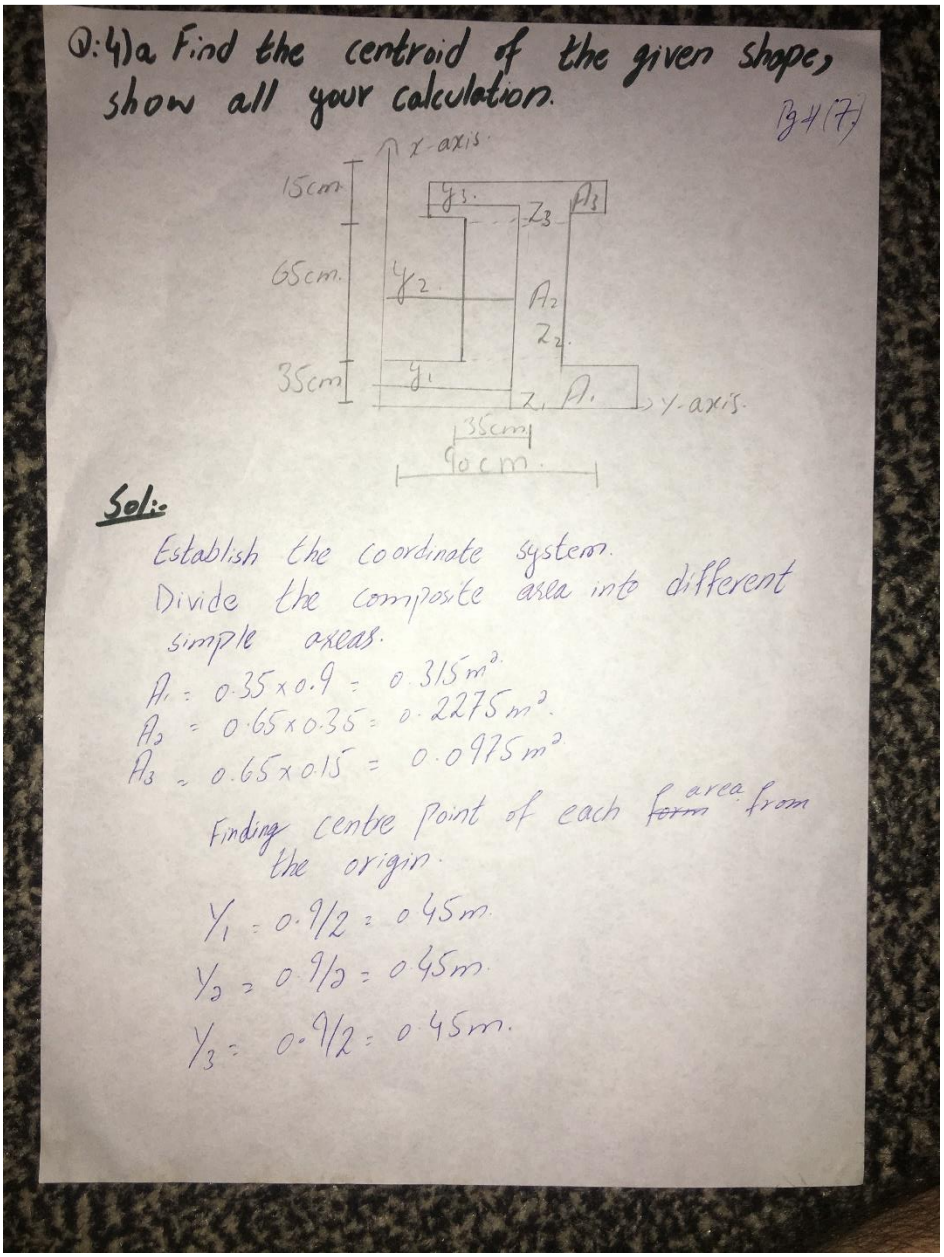


S.F diagram = 2°.

9.27 kN/m. B.M diagram = 3°



Q4 (a) Find the centroid of the given shape, Show all your calculations



Now For Z

$Z_1 = 0.35/2 = 0.175\ m$

$Z_2 = 0.35 + (0.65/2) = 0.35 + 0.325 = 0.675\ m$

$Z_3 = 0.35 + 0.65 + 0.15/2 = 0.35 + 0.65 + 0.075$

$Z_3 = 1.075\ m$

$$Y_c = \frac{A_1 Y_1 + A_2 Y_2 + A_3 Y_3}{A_1 + A_2 + A_3}$$

$$= \frac{(0.315 \times 0.45m) + (0.2275 \times 0.45m) + (0.0975 \times 0.45m)}{0.315 + 0.2275 + 0.0975}$$

$$= \frac{0.1417 + 0.10237 + 0.04387}{0.43525}$$

$$= \frac{0.28794}{0.43525}$$

$Y_c = 0.6615\ m$

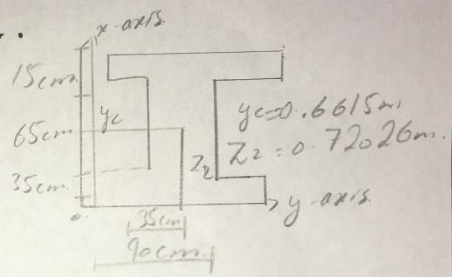
$$Z_c = \frac{A_1 Z_1 + A_2 Z_2 + A_3 Z_3}{A_1 + A_2 + A_3}$$

$$Z_c = \frac{(0.315 \times 0.175m) + (0.2275 \times 0.675m) + (0.0975 \times 1.075m)}{0.43525}$$

$= \frac{0.05512 + 0.153562 + 0.104812}{0.43525}$ Pg # (9)

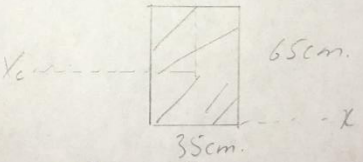
$= \frac{0.313945}{0.43525}$

$Z_c = 0.72026\ m.$



Part (b)

Moment of Inertia for (65cm × 35cm).



$I = \frac{bh^3}{12} = \frac{(35)\cdot(65)^3}{12}$

$I = \frac{35 * 274625}{12}$

$I = \frac{9611875}{12}$

$I = 800989.58\ cm^4$

Radius of gyration.

$$r_{x_b} = \frac{h}{\sqrt{12}} = \frac{65}{\sqrt{12}} = 18.76\ cm.$$

$$r_{y_b} = \frac{b}{\sqrt{12}} = \frac{35}{\sqrt{12}} = 10.1\ cm.$$

$$r_x = \frac{h}{\sqrt{3}} = \frac{65}{\sqrt{3}} = 37.52\ cm.$$

Section modulus:-

$$S = \frac{bh^2}{6}$$

$$S = \frac{35 \times (65)^2}{6}$$

$$S = \frac{35 \times 4225}{6}$$

$$S = \frac{147875}{6}$$

$$S = 24645.83\ cm^3.$$

Q5: Explain work, energy and power in details along with practical examples from daily life.

WORK

Work may be defined as (When a force act on a body, it displaces a body in the direction of force then work is said to be done)

OR

The scalar product of force and displacement is known as work.

SYMBOL

It is denoted by ‘w’

MATHEMATICALLY

Mathematically it can be written as

Work = force . displacement

$W = F . S$

It is a transfer of energy. The work is done on object when we transfer energy to that object.

UNIT

The S.I unit of work is Joule “J”

The work done will be 1 Joule if a unit of force act on a body and displace it through a unit distance in the direction of force

J= N.m

QUANTITY

It is a scalar quantity

EXAMPLE

Pushing the table over ground it cover some distance.

Pushing a car horizontally from rest.

Walking up stairs

ENERGY

The ability of a body to do work is called energy

TYPES OF ENERGY

There are two types of energy

Kinetic Energy

Potential Energy

MATHEMATICALLY

Mathematically it can be written as

$E= mc^2$

EXAMPLE

Example of energy is “energy obtained from batteries and generators”

Burning of fire transfer heat energy

Light energy is also example of energy

UNIT

The unit of energy is same as that of the work i.e. “J”

POWER

It is the time rate of doing work is called power

OR

The work done in a unit time is known as power

SYMBOL

It is denoted by “P”

MATHEMATICALL FORM

It can be written as

$P = w/t$

UNIT

The S.I unit of power is **watt** (w)

The power will be one watt if a unit work is done in a unit time

$1 \text{ watt} = 1 \text{ joule}/1 \text{ sec}$

$1 \text{ watt} = 1 \text{ J}/1 \text{ sec}$

$W = J.\ S^{-1}$

EXAMPLE

Solar energy can be used to power road signs.

Shuttle puts out a few GW (Giga-watts, or 10^9 W) of power.