UNIVERSITY OF JOHANNESBURG

PROGRAM	: **BACHELORS OF ENGINEERING TECHNOLOGY**
SUBJECT	: **BASIC SCIENCE (APPLIED MECHANICS)1**
CODE	: **APMCIA1**
DATE	: WINTER EXAMINATION 20 JULY 2018
DURATION	: (SESSION 1) 8:00 – 11:00
WEIGHT	: 40 : 60
TOTAL MARKS	: 83

ASSESSOR	: Ms N REYNECKE
MODERATOR	: Mr F THAIMO
NUMBER OF PAGES	: 4 PAGES, 1 ANNEXURES (printed double sided)

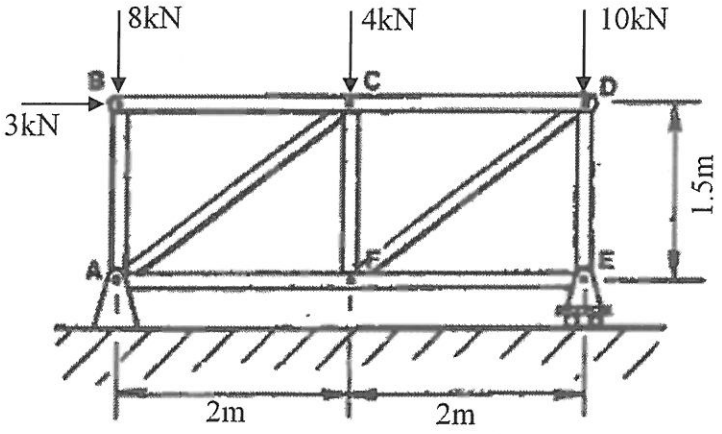
INSTRUCTIONS	: ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.
REQUIREMENTS	: NONE.

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS.

Question 1 [9]

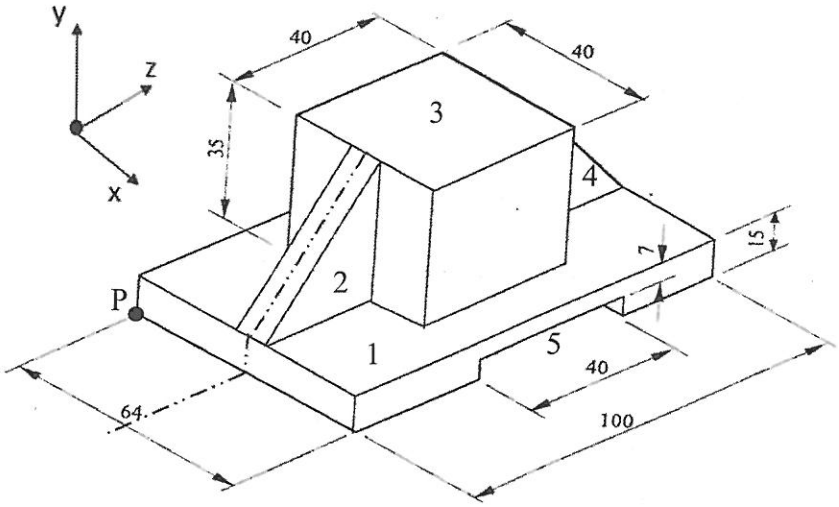
For the following loaded truss, calculate the reactions at A and B. A is pinned and B is on rollers.



Question 2 [21]

The following figure shows a composite object consisting of a cube, two triangular prisms and a large rectangular prism and a cut out rectangular prism. The rectangular prism has a 40mm cut out section from the front to the back of the object.

P is as indicated. Please fill in Annexure A, only this spread sheet will be marked.



Question 3 [7]

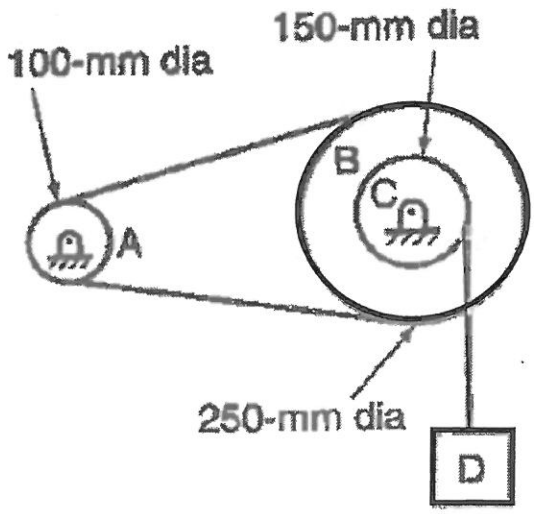
A helicopter accelerates uniformly upwards at $1m/s^2$ to a height of 300m. By the time it reaches 350m, it has decelerated to 0 velocity. It then accelerates horizontally at $4m/s^2$ to a velocity of 15m/s, determine the total time required for this sequence.

Question 4 [13]

As shown in the figure, weight D is suspended by a rope wrapped around a pulley C. Pulley B and C are fastened together and pulley A is belt driven by pulley B. Starting from rest weight D drops 18m in 3 seconds. For each pulley, calculate:

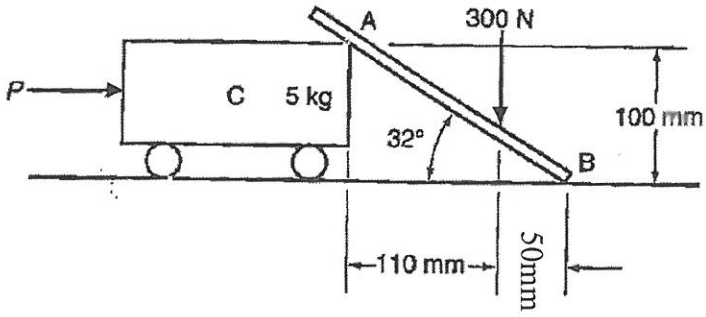
a) The number of revolutions
b) The angular velocity
c) The angular acceleration at t= 3seconds

Calculate the linear values before converting to angular values. All pulleys are frictionless



Question 5 [10]

Block C rests on rollers and supports bar AB as shown. The coefficient of friction for all surfaces are 0.4. Determine the force P and the friction force at B when slipping first occurs at either A or B. Neglect the weight of AB. First find out if slipping occurs at A or B.



Question 6 [6]

A 4000N (A) and 3000N (B) collide on an icy road and remain together. At the time of impact, car A was traveling at 50km/hr east, and car B was traveling at 30km/hr north. Determine the resulting velocity and direction.

Question 7 [10]

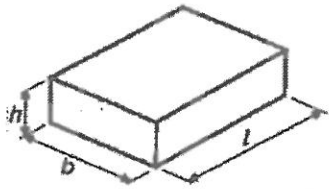
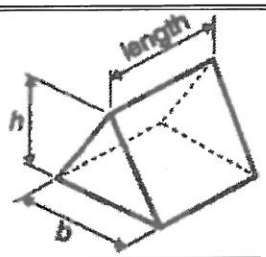
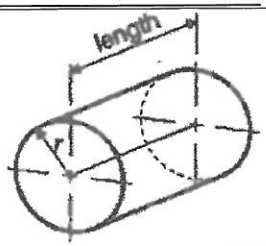
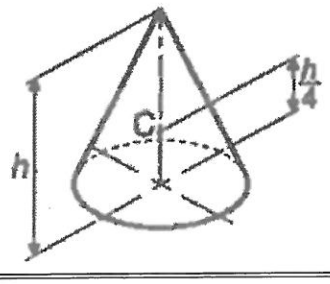
A metal block starts from rest and slides 20 m down a chute that is inclined at 45° to the horizontal. It then continues to slide along a horizontal length of the chute and eventually comes to rest. If $\mu = 0{,}37$ between the chute and the block, calculate the horizontal length of the chute. (Please use conservation of energy to solve this question)

Question 8 [7]

A ball is attached to a string that is 1.5m long. It is spun so that it completes two full rotations every second. What is the centripetal acceleration felt by the ball?

Exam Formula Sheet

Motion formulas	Motion formulas with gravitation	Angular motion formula
$v = u \pm at$	$v = u \pm gt$	$\omega_f = \omega_i \pm \alpha t$
$v^2 = u^2 \pm 2as$	$v^2 = u^2 \pm 2gh$	$\omega_f^2 = \omega_i^2 \pm 2\alpha\theta$
$s = ut \pm \frac{1}{2} at^2$	$h = ut \pm \frac{1}{2} gt^2$	$\theta = \omega_i t \pm \frac{1}{2}\alpha t^2$
$\bar{v} = (u + v)/2$	$\bar{v} = (u + v)/2$	$\bar{\omega} = (\omega_f + \omega_i)/2$
$s = \bar{v} \times t$	$h = \bar{v} \times t$	$\theta = \bar{\omega} t$
$a = \Delta v/t$	$g = \Delta v/t$	$\alpha = \Delta\omega/t$
$W = F.d$	$W = T.\theta$	$\theta = s/r$
$W = \bar{F}.d$	$P = T.\theta/t$	$\omega = v/r$
$W_\mu = \mu.N.d$	$P = T.\omega$	$\alpha = a/r$
$W_{TR} = TR.d$	$k = F/x$	$E_K = \frac{1}{2}mv^2$
$W_{TE} = TE.d$	$W = \frac{1}{2} k.x^2$	$E_P = mgh$
$P = W.d/t$	Change in momentum = $m\Delta v$	$E_\mu = \mu.N.s$
$P = F.v$	Impulse = change in momentum	$E_{TR} = TR.s$
$P_{out} = TE.v$		$E_{TE} = TE.s$
$\eta = \frac{P_{out}}{P_{in}} \times 100\%$	$CF = m\omega^2 r = mv^2/r$	$E_{Torque} = T.\theta$
$a_L = \alpha r$	$a_C = \omega^2 r$	$a_R^2 = a_L^2 + a_C^2$

	Volume	Centroid
	Length x b h	**Rectangular prism** At l/2, b/2, and h/2
	½ x b x h x length	**Triangular prism** At the point where l/2, b/2 and h/2 intersect.
	$\pi \times r^2 \times$ length	**Cylinder** At the circle centre, halfway along the length l/2a
	1/3 base area x height	**Cone** h/4 from the base

Initial & Surname:_____ Student number:_____

Sec	l	h	b	V	x	Vx	y	Vy	z	Vz
1										
2										
3										
4										
5										
Σ										
					x		y		z	

Initial & Surname:_____ Student number:_____

Sec	l	h	b	V	x	Vx	y	Vy	z	Vz
1										
2										
3										
4										
5										
Σ										
					x		y		z	