NEW ZEALAND DIPLOMA IN ENGINEERING
(Electrical)

DE4101: Engineering Fundamentals
DE4101-Assignment – 01

Student ID:	
Time Allowed:	Ten days
Total Marks:	70

IMPORTANT NOTES:
1. This assignment is a part of the final mark of this paper. You must complete this assignment if you wish to be eligible to pass this paper.
2. The invigilator will provide you enough copies of paper where you will write your answers. Please write legibly, otherwise your answer may not be given the corresponding mark.
3. Ensure that this cover sheet is filled in and attached to your completed examination.
4. Any student caught cheating will receive ZERO. A seating plan will be created by the invigilator at the time of the exam, and if copying is identified (i.e., your work is the same as any of the students seated around you), it will be marked ZERO.
5. Refer to your Course Handbook for regulations relating to Recount/ Reconsideration of Marks. These must be applied for WITHIN 3 DAYS from the date Assessment Feedback is provided by the lecturer. All applications are to be submitted to your lecturer.
6. Resubmission is a request for further information by your assessor and this can only occur once to support one test or assignment for this paper. If eligible, these must be applied for WITHIN 3 DAYS from the date Assessment Feedback is provided by the lecturer. All applications are to be submitted to your lecturer.
   Resits/Reassessment are not available for this assessment.

Instructions:

1. Enter your Student ID number in the space provided above.
2. All answers must be written in this book, in the spaces available, or on extra sheets supplied on request.
3. Write your student ID and the question number on each extra page and enclose it in the book adjacent to the relevant question.
4. CROSS OUT any work that you do not wish to have marked.
5. This examination counts towards **15%** of your final mark for the course.
6. Answer ALL questions.
   .

For Official Use Only:

Question:	01	02	03	04	05	06	Total
LO.:	01	01	01	01	01	01	
Out of:	10	10	14	16	10	10	70
Marks:							

QUESTION ONE: [10 marks]
SI units and Units conversion

a) **Define the following items and provide their appropriate unit.** (6 marks)

	Definition	Unit	Marks
Voltage			
Density			
Velocity			
Stress			

b) **Convert the following to the mentioned units.** (4 marks)

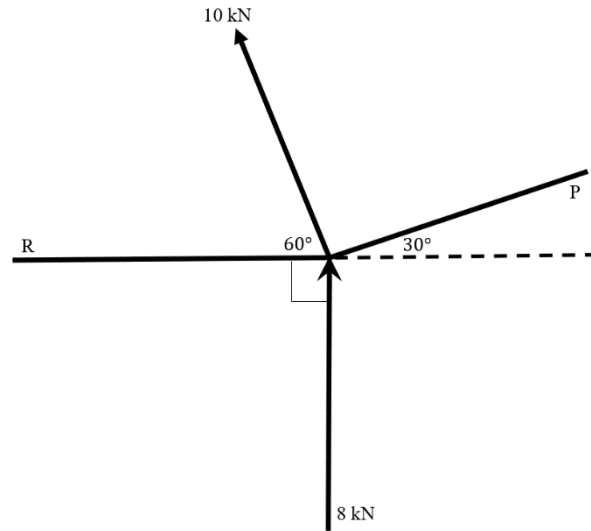|		
i.	0.054 GN to N	
ii.	1200 L/s to m³/s	
iii.	320 N/mm² to MN/m²	
iv.	25 g/s to kg/h	

Extra workspace. Number your questions carefully. Cross out work not to be marked.

QUESTION TWO: [10 marks]

Analysis of concurrent force system

a) At a pin-jointed truss system with equilibrium, four forces are acting. Determine the unknown forces P and R and their nature.
(6 marks)

b) Use graphical analysis to obtain an equilibrant force for a system with four vectors acting on the same point. No calculations are needed in your answer. (3 marks)

c) What is the difference between speed and velocity? (1 mark)

Extra workspace. Number your questions carefully. Cross out work not to be marked.

QUESTION THREE: [14 marks]
Velocity and acceleration, motion with constant acceleration

a) A car has travelled between two points with 2496 m distance for 240 seconds. The following figure is the graph of velocity-time of the car during the journey. If maximum velocity of the car is $16\ m/s$ and the magnitude of acceleration is triple of the magnitude of deceleration, calculate the acceleration of the vehicle (in the first phase of travel). (5 marks)
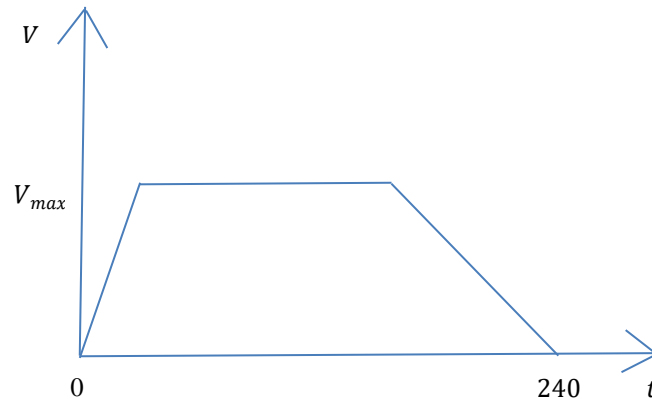
b) A Super Sport Bugatti Cheiron with mass of 1980 kg reaches a top speed of 490 km/hr from the rest travelling 1.5 km distance. Assuming constant acceleration, calculate:

      i.   **the acceleration of the car and the trust force of the car engine.**   **(5 marks)**

      ii.   **Calculate the kinetic energy of the car when it has a speed of 360 km/hr.**   **(2 marks)**

      iii.   **Sketch a free body diagram of the car at a constant speed. Your answer should have FOUR forces.**   **(2 marks)**

Extra workspace. Number your questions carefully. Cross out work not to be marked.

QUESTION FOUR: [16 marks]

Conservation of energy and momentum

a) A 1000 kg vehicle with a speed 2m/s starts climbing at a 10° angle ramp. The speed of the vehicle will increase to 12 m/s using its 8000 N engine driving force. Calculate the vertical height h of the endpoint of the ramp If the coefficient of friction between the surface of the ramp and the wheel of the vehicle is 0.15. (10 marks)

$V_2 = 12 \ ^m/_s$

$V_1 = 2 \ ^m/_s$

10°

$h =?$

b) A 70 kg football player is at rest on the field. A 0.5 kg ball is thrown towards the player at a speed of 20 m / s . After receiving the ball, the player throws it back in the opposite direction $(180^°)$ at a speed of 15 m / s . What is the speed of the player after the throw. **(6 marks)**

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QUESTION FIVE: [10 marks]
Beam support reaction

The following figure shows a free body diagram of two forces (8 kN and 12 kN respectively) acting on a 19 m long beam. A 6 kN/m UDL acts over a 9 m length as shown.
Disregarding the weight of the beam determine the reaction forces at the pin joint A and the roller support B respectively.
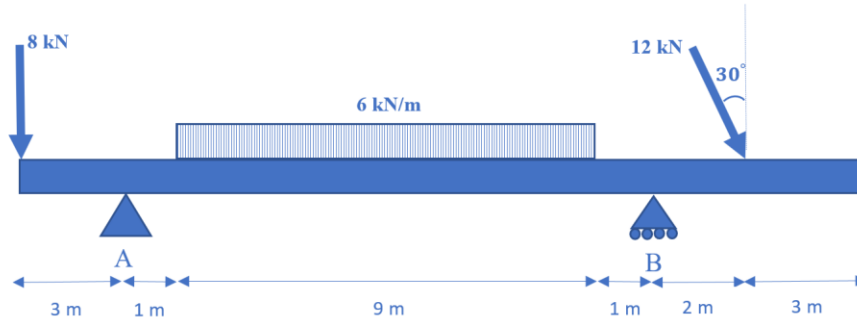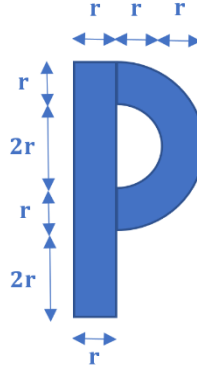
8 kN

12 kN

30°

6 kN/m

A

B

3 m   1 m   9 m   1 m   2 m   3 m

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QUESTION SIX: [10 marks]
Centroid of gravity

a) **The diagram shows a letter "P" made by a rectangle and a semicircle. The hole inside of the semicircle is another semicircle. Two mentioned semicircles have the same centre. If $r = 1$, find the position of the centroid of the letter "P" shown below.**   **(8 marks)**

b) **Describe how the centroid moves if the semicircle hole is filled with the same material as the letter "P" is made by.**   **(2 marks)**

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