

2021/2022 SEMESTER ONE MID SEMESTER TEST

Diploma in Electrical & Electronic Engineering (DEEE)  
2<sup>nd</sup> Year Full-Time

**PHYSICS FOR ENGINEERS**

Time Allowed: 1.5 Hours

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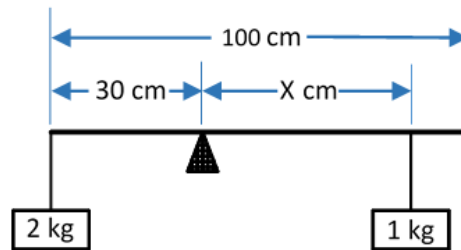
Instructions to Candidates

1. The examination rules set out on the last page of the answer booklet are to be complied with.
2. This paper consists of **TWO** sections:
  - Section A - 10 Multiple Choice Questions, 3 marks each.
  - Section B - 5 Short Questions, 14 marks each.
3. **ALL** questions are **COMPULSORY**.
4. All questions are to be answered in the answer booklet. Start each question on a new page.
5. Fill in the Question Numbers, in the order that it was answered, in the boxes found on the front cover of the answer booklet under the column "Question Answered".
6. This paper consists of 7 pages.
7. The question paper must be submitted together with the answer booklet at the end of this test.

**Section A [3 marks each]**

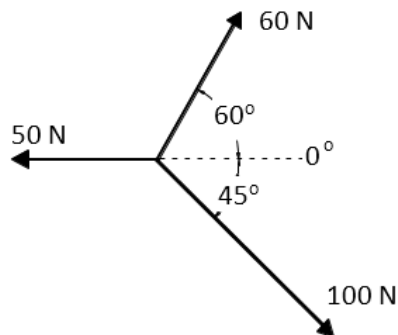
**MULTIPLE CHOICE QUESTIONS**

- A1. A 100 cm long uniform beam of mass 1 kg is supported by a pivot as shown in Figure A1. If the system is in static equilibrium, what is the value of X?



**Figure A1**

- (a) 40  
(b) 50  
(c) 60  
(d) 70
- A2. In Figure A2, the magnitude and direction of the resultant force are \_\_\_\_\_ N and \_\_\_\_\_.



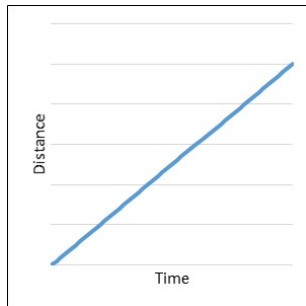
**Figure A2**

- (a) 54 ....20°  
(b) 54....-20°  
(c) 195 ...15°  
(d) 195... -20°

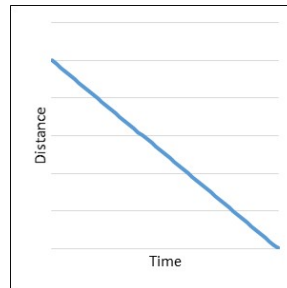
- A3. Which one of the following is a type of force that can act on a body?
- (a) Torsion
  - (b) Compression
  - (c) Shear
  - (d) All of the above.
- A4. Body temperature is a \_\_\_\_\_. The body weight is a \_\_\_\_\_.
- (a) vector .....scalar
  - (b) vector .....vector
  - (c) scalar .....vector
  - (d) scalar .....scalar
- A5. Which one of the following forces is needed to keep a 2 kg stone moving in a horizontal circle of radius 2 m at a speed of 3 m/s?
- (a) A centripetal force of 9 N towards the centre of the circle.
  - (b) A centrifugal force of 9 N away from the centre of the circle.
  - (c) A centripetal force of 4.5 N towards the centre of the circle.
  - (d) A centrifugal force of 4.5 N away from the centre of the circle.
- A6. Which one of the below statements is true when an object is in uniform motion?
- (a) The velocity is zero.
  - (b) The displacement is zero.
  - (c) The object is sliding on a frictionless surface.
  - (d) The acceleration is zero.
- A7. If the static coefficient of friction between an object and a rough plane is 0.6, then the kinetic coefficient of friction is likely \_\_\_\_\_.
- (a) 0.5
  - (b) 0.6
  - (c) 0.7
  - (d) 0.8

A8. Which one of the following distance-time plots shown in Figure A8 is a constant positive acceleration?

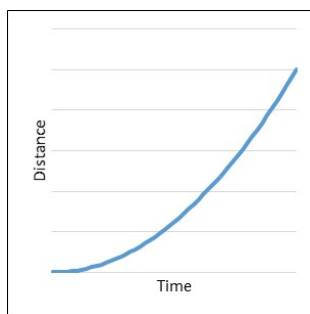
(a)



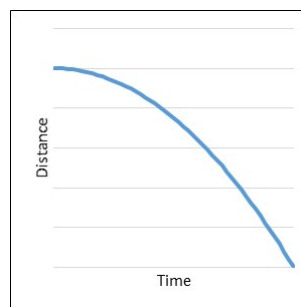
(b)



(c)

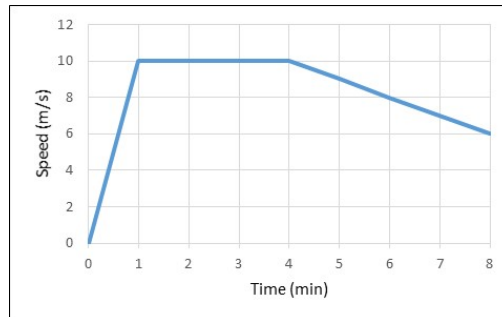


(d)



**Figure A8**

- A9. Figure A9 shows the speed-time plot of a cyclist during an 8-minute period. Which one of the following statements is TRUE?



**Figure A9**

- (a) The total distance travelled during this 8-minute period is 80 m.
  - (b) The average speed during this period is 8.375 m/s.
  - (c) The cyclist has stopped for 3 minutes.
  - (d) All of the above answers are correct.
- A10. An object of mass 2 kg moves against a frictional force of 4N when it was pulled by a 10 N force along a horizontal surface. Which one of the following statements is correct?
- (a) It has a speed of 3 m/s
  - (b) It has a speed of 5 m/s
  - (c) It has an acceleration of 3 m/s<sup>2</sup>
  - (d) It has an acceleration of 5 m/s<sup>2</sup>

**Section B [14 marks each]**

- B1a. Define tensile stress and tensile strain of an elastic material. (6 marks)
- b. A mass of 10 kg is suspended from the ceiling by an aluminium wire of length 2 m and diameter 2 mm. Determine the extension of the wire given that the Young's modulus of aluminium is  $7 \times 10^{10} \text{ N/m}^2$ . (8 marks)

- B2a. Explain static equilibrium? (3 marks)
- b. The hinge of the crooked rod shown in Figure B2b is at O on the wall. Determine the resultant moment of the forces about O. (11 marks)

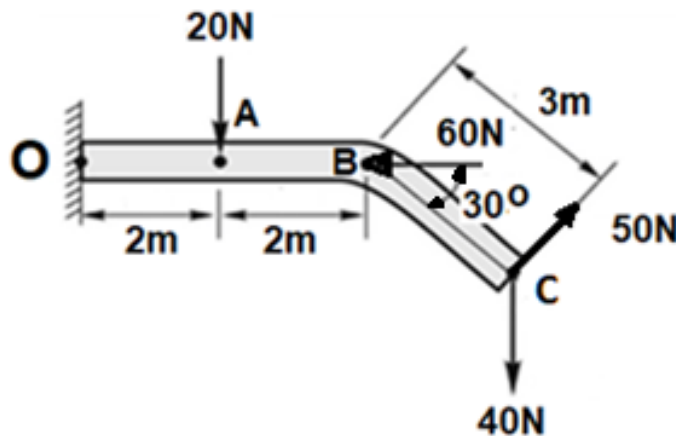


Figure B2b

- B3. During its mission to planet Mars, as part of an experiment, the Perseverance Rover launches a 1.0 kg ball vertically upwards on Mars with an initial velocity of 12.0 m/s. The ball reaches the maximum height in 3.24 sec before dropping back down to the surface of the planet.
- a. Determine the acceleration due to gravity on planet Mars. (6 marks)
- b. Determine the maximum height the ball can reach. (4 marks)
- c. If the same experiment is done on Earth, how high can the ball reach? (4 marks)

- B4a. The centripetal force acting on a 5 kg ball attached to a strong non-elastic 1.5 m string moving in a circular motion is 80N. What is the tangential velocity of this ball and how long does it takes for the ball to complete one circular motion? (7 marks)
- b. The coefficient of friction between an autonomous electric vehicle and the circular road it is navigating is 0.5. If the maximum velocity achievable without skidding is 30 m/s, calculate the radius of this circular road. (7 marks)
- B5. When a 30 g metal object moving at 80m/s hits a wall, it stops 5 cm inside the wall. Determine the
- a. force of the metal object on the wall (5 marks)
  - b. acceleration/deceleration of the metal object (3 marks)
  - c. time of acceleration/deceleration (3 marks)
  - d. impulse of the collision (3 marks)

**\*\*\*\*\* End of Paper \*\*\*\*\***

**Formulae**

1.  **$g = 9.8 \text{ m/s}^2$**
2. **Centripetal acceleration =  $v^2 / r$**
3.  **$v = u + at$**
4.  **$v^2 = u^2 + 2as$**
5.  **$s = ut + \frac{1}{2} at^2$**
6. **Young's modulus  $Y = \text{stress/strain}$**
7. **One tonne = 1000 kg**