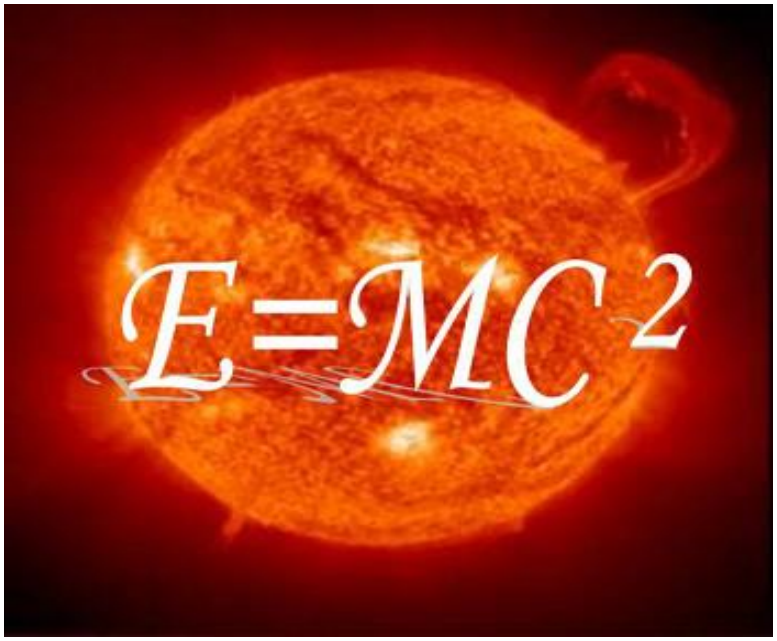
E

DC fundamentals EE3103

Student workbook calculations

Mechanics part two of two



Student name

MECHANICS: PRACTICE EXERCICES

1) A force of 80N is applied to the end of a bar 2.0m long. The bar is pivoted 0.45m from that end. Calculate the force required to be applied to the other end to maintain balance.

2) A block has a mass of 100kg. Calculate the downward force.

3) A plank is 4m long and suspended between 2 saw stools, one at each end. A 145kg mass sits on the middle of the plank. Calculate the force on each saw stool.

4) Give a practical example of a 3rd order lever (one you have seen) and draw its single line equivalent.

5) Calculate the torque required to drive a pulley that has a diameter of 0.5m and is lifting a mass of 10kg.

6) Calculate the energy required to raise 200kg up a vertical distance of 27m.

7) A turning moment of 18Nm is required to tighten a nut on a busbar clamp. What is the minimum force that must be applied to a spanner of effective length 250mm if the nut is not to be over tightened?

8) A motor has an input power rating of 500W. If it is 70% efficient, calculate the output in horsepower.

9) A pump raises 0.3 cubic metres of water per minute from a well that is 3m deep. Calculate the input power to the pump if it is 80% efficient.

10) A motor lifts a 10kg load, 5m vertically in 3 seconds. If the motor is 90% efficient calculate the input power.

11) A motor lifts a 5.5kg load up 10m while rotating at 75 rpm. What is the input power rating of the motor if it is 80% efficient.

12) A motor producing 50Nm of torque at 600rpm has a 300mm diameter pulley attached to the output shaft. A drive belt connects this pulley to another pulley having a diameter of 175mm. Calculate the torque and speed (in rpm) on this smaller pulley.

13) Sketch a Hypoid bevel-tooth gear.

14) When are drive gears used instead of drive belts.

15) A 5kW motor (input) having a 90% efficiency rating, drives a generator of 60% efficiency. Calculate the maximum generator output.

16) The reading on a kWh meter over 2 hours is 13.5 units.
Calculate the average power.
How many joules have been used in total?

17) Calculate the force applied if a 2kg mass is accelerated at a rate of 10m/s²

18) A 5kW motor runs for 5 hours. Calculate total kWhs, total Watt-seconds, and total joules.

19) A 250kg load is to be raised at a speed of 5m/s.
The gearing is 90% efficient and the motor is 70% efficient.
Calculate the input power to the motor.

20) A pump delivers 250 litres of water from a 20m deep trench every 5 seconds. The pump runs for a total of 5 hours.
Calculate a) The total energy used in joules, Watt-seconds and kWhrs.
b) Minimum power rating of the motor.
c) Total cost to pump out all the water.

Assume all equipment is running at 100% efficiency and use 25 cent per unit as the cost of energy.

Answers

1) 23.22N
2) 981N
3) 711N
4) see tutor
5) 24.5Nm
6) 52972 joules (ws or Nm)
7) 72N
8) 0.469hp
9) 183 watts
10) 181.6 watts
11) 5.3kW
12) 1028rpm, 29Nm
13) see tutor
14) see tutor
15) 2.70 kW
16) 6.75kW, 48.6MJ
17) 20N
18) 25kW, 90MJ, 90MWs
19) 19.46kW
20) a)176.58MJ, 176.58MWs, 49.05kWh
b) 9.81kW
c) $12.26