

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
MAY 2020

CYFNOD ARHOLIADAU
MAI 2020

MODULE CODE: M4X00385
Engineering Science 1

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Scientific Calculator

Adnoddau neu ddefnyddiau sydd eu hangen - Cyfrifiannell Wyddonol

REMEMBER:

Take Gravity as 9.81m/s^2

Give all answers to 2.d.p unless otherwise instructed.

1.

A cage in a mine shaft performs the first part of its decent with a uniform acceleration of 0.5m/s^2 and the remainder of its decent to the bottom of the shaft with uniform retardation of 1.5m/s^2 . If the total time for decent is 45 seconds, draw a velocity time graph [3 marks] and calculate the depth of the shaft. [15 marks]

2.

In a laboratory test a flywheel is accelerated uniformly from rest for a brief period during which time the flywheel turned through 5.5 rev. The flywheel was then allowed to come to rest against friction with uniform retardation during which time it is turned through 55rev. If the total time of the motion was 90 seconds, draw an angular velocity time graph [3 marks] and determine,

- a. The maximum angular velocity in rad/s , [14 marks]
- b. the angular acceleration in rad/s^2 , [4 marks]
- c. the angular deceleration in rad/s^2 . [4 marks]

3.

A motor car of mass 1050kg is being driven up an incline of 1 in 4 measured along the slope. If the engine develops an output power of 65kW, 25% of which is lost through the transmission to the wheels, and there is a constant frictional resistance of 350N. construct a forces diagram [3marks] and calculate :

- a. The constant speed which the car can maintain up the incline. [12 marks]
- b. Given that the car travels 24m up the slope from rest to this velocity, calculate the change in energy in KJ. [7 marks]
- c. The speed with which the car would travel along a level road if friction effects and the power available at the road wheels remains unchanged. [4 marks]

$$P = F.v \quad PE = mgh \quad KE = \frac{1}{2}mv^2$$

4.

A quantity of air in a cylinder is compressed to one sixth of its volume. The pressure is initially 125kN/m^2 and the temperature rises during the compression from 18°C to 125°C . What is the pressure of the compressed air in MN/m^2 ? If the air is allowed to expand at constant temperature to its original volume, what will be the new pressure in KN/m^2 ? [18 marks]

5.

A section of horizontal tube full of water of density 1000kg/m^3 tapers from 0.35m to 0.05m in diameter. Given that the pressure in the wider end of the pipe is 234kPa and at the narrow end is 123kPa, calculate the velocities at each end of the pipe and the volumetric flowrate.

[20 marks]

$$d_1^2 v_1 = d_2^2 v_2 \qquad gh_1 + \frac{p_1}{\rho} + \frac{v_1^2}{2} = gh_2 + \frac{p_2}{\rho} + \frac{v_2^2}{2}$$

6.

Find the heat transfer coefficient for the material of a door (dimensions 2m x 1m) of a furnace given the heat flow rate is 40,000W and that the internal temperature is 450°C and the external temperature is 32°C .

[4 marks]

Given that the door is made from steel of thermal conductivity $54\text{W/m}^\circ\text{C}$, calculate how thick the door is.

[4 marks]

$$Q = -UA (T_2 - T_1)$$

7.

A 150N load is added to the end of circular cross section steel rod that has a length of 0.5m and a diameter of 0.035m. The steel has a Young's modulus value of 230GN/m^2 ; calculate the stress and extension of the rod.

[13 marks]

$$E = \frac{\sigma}{\varepsilon}$$

8.

Calculate the torque for a solid shaft of diameter 100mm and a length of 2m given that it has a modulus of rigidity of 100GN/m^2 , and the angle of twist is 0.75° .

[9 marks]

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l} \qquad J = \frac{\pi D^4}{32}$$

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