TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

DIPLOMA IN ELECTRICAL ENGINEERING (DEE 1)

EME 2130
MECHANICAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATIONS

YEAR 1 SEMESTER 1

SERIES: MARCH, 2014

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet
   - Scientific Calculator

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry equal marks.
5. **This paper consists of FOUR printed pages.**

Question ONE

(a) Define the following terms and state their SI units:

(i) Power
(ii) work
(iii) Energy

(4 marks)

(b) A car of mass1.1t is driven at constant speed of up and inclined of 10^{o}. The rolling resistance is 180N and air 400N. Calculate:

(i) Trachre effort
(ii) Trachre when the car has a uniform acceleration of $0.6m/s^2$

(8 marks)

(c) A 90t locomotive hauls a train of coaches of mass 300t up and inclines of 1 in 80 of a distance of 1000m. The rolling resistance is 60N/t. If the acceleration is $0.1m/s^2$, calculate the total work done. **(8 marks)**

Question TWO

(a) A flywheel 1.2m in diameter is uniformly accelerated from rest and revolves completely seventy times in reaching a speed of 120 revolutions per minutes. Calculate:

(i) Time take
(ii) Angular acceleration
(iii) Linear acceleration of a point on the rim

(8 marks)

(b) A body rotates at an initial angular velocity $w_o rad/s_1$ if it attains a final angular velocity wrad/s in time t seconds with a uniform angular acceleration α rad/s^2 show that:

$$\theta = \omega_o t + \frac{1}{2}\alpha t^2$$

(6 marks)

(c) An engine flywheel in the form of α thin rim of 1m diameter is designed to store 200kJ of Kinetic Energy at a speed of 20 revolutions per seconds. Calculate:

(i) The mass of metal required in the rim
(ii) If the diameter is increased by 1.2m, calculate the mass required

(6 marks)

Question THREE

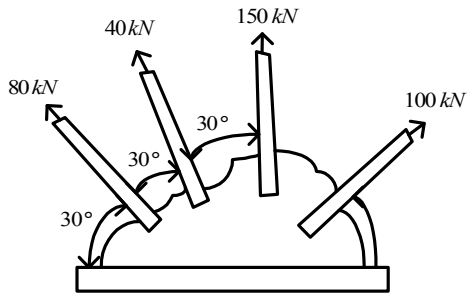
(a) Define the following terms and state their SI units:

(i) weight
(ii) Moments
(iii) Torque

(5 marks)

(b) State the principle of moments. **(1 mark)**

(c) For the system of force show in Figure 1, calculate:



(i) The resultant force
(ii) The angle made of its line of action with vertical

(14 marks)

Question FOUR

(a) Define the following:

(i) Stress
(ii) Strain

(2 marks)

(b) State hook's law. **(1 mark)**

(c) A rubber rad for a machine mounting is to carry a load of 10KN and to compress 10mm under this load. If the stress in the rubber is not exceed 280k/m^2, calculate:

(i) Diameter of the pad
(ii) Thickness of the pad

$$\begin{bmatrix} E = For\ \ rubber \\ 1MN/m^2 \end{bmatrix}$$

Take:

(9 marks)

(d) A bar of titanium alloy of length 200mm and a square cross-section of 7.5mm x 7.5mm is pulled axially by a force of 15kN. Calculate the percentage decrease in thickness:

$\left[\varepsilon = 106GN/m^2, \quad V = 0.33\right.$

(8 marks)

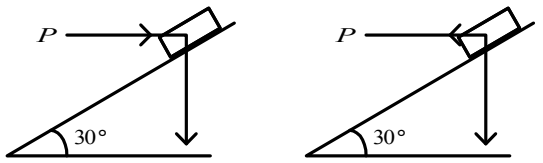
Question FIVE

(a) A train accelerates uniform from rest to reach 60km/hr is 300 seconds. After which the speed remains constant for 500 seconds. At the end of thick time the train decelerates to rest in 200 seconds. Represent the motion on:

(i) Velocity-time graph
(ii) Calculate the total distance

(6 marks)

(b) A body of weight 100N is at rest on an inclined plane as shown in Figure 2. A force P is applied horizontally. Calculate:



(i) The value of P when the body is moving up the slope
(ii) The value of P when the body is moving down the slope

(14 marks)