TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MARINE ENGINEERING (DMAE)

EMR 2212
APPLIED MECHANICS

END OF SEMESTER EXAMINATIONS

YEAR 2 SEMESTER 2

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

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

2. This paper consists of **FIVE** Questions.
3. Answer Question **ONE (Compulsory)**, **ONE** Question from Section **B** and **ONE** Question from Section **C**.
4. **This paper consists of THREE printed pages.**

SECTION A : (Compulsory)

Question ONE

(a) With reference to Torsion of round bars prove that the simple torsion equation can be given by:

$$\frac{\tau}{r} = \frac{T}{J} = \frac{G\theta}{L}$$

(Symbols retain their usual meaning) **(10 marks)**

(b) A cash iron pulley is 200mm wide and 25mm thick with a mean diameter of 2m. Considering the pulley as a thin king, calculate:

(i) The moment of Inertia of the ring
(ii) The torque required to produce speed of 5revs/sec in 15secs.
Take density of cast iron as 7.2Mg/m^3

(10 marks)

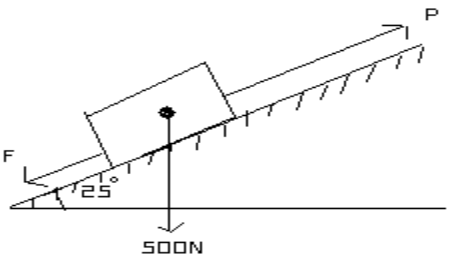
SECTION B : (Answer only **ONE** Question)

Question TWO

A body of weight 500N is lying on a rough plane inclined at angle of 25^o with the horizontal. It is supported by an effort P parallel to the plane as shown in the figure below:

Calculate the maximum and minimum values of P for which the equilibrium can exist, if the angle of friction is 20^o.

NB: Derive any formula used.



(20 marks)

Question THREE

Two motor boats MV Safina and MV Likizo on parallel lines. MV Safina starts with a uniform acceleration of 0.2m/sec and attains a speed of 24.3KNOTS, which is maintained constant afterwards. MV Likizo leaves 1 minute after with a uniform acceleration of 0.4m/sec to attain a maximum speed of 38.9KNOTS which is maintained constant afterwards. Calculate when MV Likizo will overtake MV Safina 5 at the same point. Take 1KNOT = 1.852km/hr. **(20 marks)**

SECTION C - (Answer **ONE** Question from this Section)

Question FOUR

(a) A hollow bar has an external diameter 'D' and an internal diameter 'd' such that D = 2d. For the bar show that the strain energy stored per unit volume due to torsion can be given by:

$$U = \frac{5\tau^2}{16G}(J/m^3)$$

(10 marks)

(b) The hallow bar in (a) above is transmitting 4.5mw at 110rev/min given that the maximum shear stress must not exceed 70mN/m^2. Determine:

(i) The diameters 'D' and 'd'
(ii) The strain energy per un H volume

(10 marks)

Question FIVE

(a) State the Castigilianos' theorem as applied in strain energy methods. **(2 marks)**

(b) A load of 2.5KN slides freely on a vertical bar of 12 mm dia the bar is fixed at it's upper end and provided with a stop at the other end to prevent the load from falling off. When the load rests on the stop the bar extends by 0.1mm. Determines:

(i) The instantaneous stress 'Θ' set up in the bar if the load is lifted and allowed to drop through 12mm on to the stop.
(ii) The resulting expansion in (i) above.

(18 marks)