

**AMERICAN UNIVERSITY OF BEIRUT  
FACULTY OF ENGINEERING AND ARCHITECTURE  
MECH 230 – DYNAMICS – QUIZ 2**

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**90 MINUTES CLOSED BOOK QUIZ**

- 1- Solve the problems on this question booklet in the given space.
- 2- Use the scratch booklet before writing on the question booklet.
- 3- The scratch booklet will not be collected and will not be graded.
- 4- Neatness and clarity are important in grading.

**PROBLEM 1: 25 %**

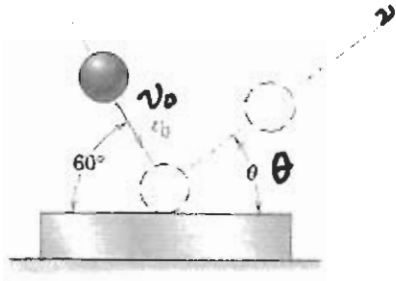
An automobile having a mass of 1500 kg travels up a  $7^\circ$  slope at a constant speed of  $v = 90$  km/h. If mechanical friction and wind resistance are neglected,

- (a) Calculate the traction force.(10 pts)
- (b) Determine the power developed by the engine if the automobile has an efficiency of  $\epsilon = 0.63$ . (15pts)



**PROBLEM 2: 25%**

The steel ball strikes the heavy steel plate with a velocity  $v_0 = 24$  m/s at an angle of  $60^\circ$  with the horizontal. The coefficient of restitution is  $e = 0.8$ .

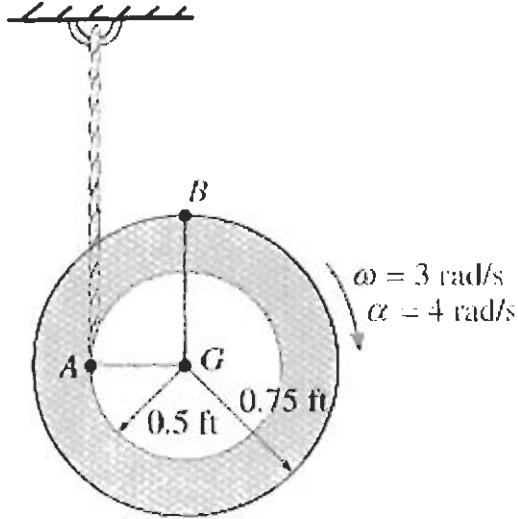


- (a) On the figure locate the line of impact and the plane of contact.(3 pts)  
(b) For the ball, draw the initial momentum diagram just before impact, impulse diagram, and the final momentum diagram just after impact.(7 pts)

(c) Calculate the velocity  $v$  and its direction  $\theta$  with which the ball rebounds from the plate. (15pts)

## PROBLEM 3: 25%

The spool shown in figure unravels from the cord, such that at the instant shown it has an angular velocity of 3 rad/s and an angular acceleration of 4 rad/s<sup>2</sup>.



(a) Velocity Analysis: **Determine** the velocity of each of the following points: point A, point G, and point B. Give answers in vector form. (15%)

(b) Acceleration Analysis: **Determine** the acceleration of each of the following points: point A, point G, and point B. Give answers in vector form. (10%)

## PROBLEM 4: 25%

Block B moves along the slot in the platform with a constant speed of 2 ft/s, measured relative to the platform in the direction shown. If the platform is rotating at a constant rate of  $\omega = 5 \text{ rad/s}$ , determine the velocity and acceleration of the block at the instant  $\theta = 60^\circ$ .

