RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

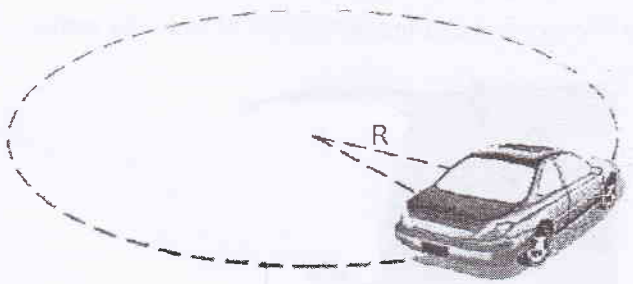
B.Sc. (General) Degree in Applied Sciences
First Year Semester I Examination – September /October 2019

PHY 1201 – GENERAL PHYSICS

Time: Two (02) hours

- **Answer ALL Questions.**
- **Calculators will be provided.**
- **Important: In each problem, you are expected to work-out detailed answers that involve clearly labeled force diagrams and clear applications of appropriate laws of physics. You will lose a large portion of marks if you simply substitute given information to equations that you memorized.**
- **Take** $g = 9.81\ m/s^2$

1. A car (Cr) of mass 1000 kg is taking a circular turn in a flat road (Rd) of radius 25 m.

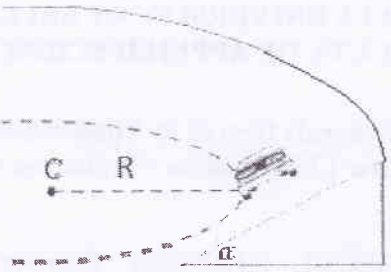


a) Ignoring the forces acting from air, determine an expression for, $\left|\vec{F}_{C(Cr)}\right|$, the magnitude of the centripetal force on the car, in terms of the actual forces acting on the car. Clearly show the appropriate logical sequence that connects the forces acting on the car with the concept of centripetal force. **(15 marks)**

b) On a dry day, $\mu_{s,max(dry)}$, the maximum coefficient of static friction between the tires and the road surface is 0.8. What maximum speed. $v_{max\,(Cr)\,dry}$, is possible for the car to take the turn under this situation? **(10 marks)**

c) On a wet day, $\mu_{s,max(wet)}$, the maximum coefficient of static friction reduces to 0.1, What maximum speed. speed $v_{max\,(Cr)\,wet}$, is possible for the car to safely take the above turn under wet conditions? **(05 marks)**

2. Suppose the local authorities rebuilt the curve in question # 1 with a 20^0 banking angle, while having the same radius as in the flat curve (refer to question #1).

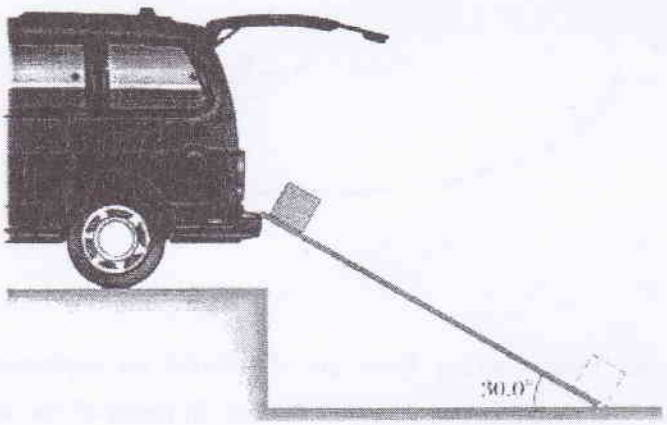


a) Derive an expression for, $\left|\vec{F}_{C(Cr)2}\right|$, the magnitude of the centripetal force on the car under this situation. Do not ignore the contribution from friction! **(25 marks)**

b) If the road conditions were same as in question #1, what maximum speed, $v_{max2(Cr),\,dry}$, is possible for the (same) car to take the banked curve on a dry day? **(10 marks)**

c) What maximum speed, $v_{max2(Cr)\,wet}$, is possible for the (same) car to take the banked curve on a wet day? **(05 marks)**

3. A box (B) of mass 20 kg was brought down from a delivery van to the ground using a 2 m long ramp (R). The ramp is inclined to the flat ground by an angle of 30^0. The box experienced a friction force of magnitude 25 N from the ramp.



a) Draw a force diagram for the box (Ignore the effects from air on the box) **(06 marks)**

b) Using the definition of work done by an external force, comment and justify, for each external force acting on the box, whether their work is positive, negative, or zero. **(14 marks)**

c) Using the definition of the work done by an external force, determine the amount of work done by each individual force acting on the box. **(06 marks)**

d) Determine the total work done $W_{tot\,(B)}$ on the box. **(04 marks)**

---- END ----