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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2018/2019 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: PHY 112E**

**COURSE TITLE: MECHANICS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 10/02/2020 TIME: 09.00-11.00 AM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of THREE (3) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Suppose we are told that the acceleration of a particle with uniform speed v in a circle

Of radius r is proportional to some power of r, say rn and some power of v, say vm.

1. Determine the values of n and m **[2 marks]**
2. Write the simplest form of an equation of acceleration. **[2 marks]**
3. Using dimensional analysis to determine the units of the following quantities
4. Density **[1 mark]**
5. $π$ **[1 mark]**
6. Determine where the following equations are dimensionally correct
7. $V=V\_{0}+at$ **[2 marks]**
8. $x=\frac{V}{2a}$ Where symbols have their usual meaning. **[2 marks]**
9. Distinguish between the following as applied to vectors
10. Scalar and Vector quantities **[2 marks]**
11. Polar and axial vectors. **[2 marks]**
12. A force $F=2.5i+4.5j-5k$ Newton is through the origin.
13. What is the magnitude of this force? **[2 marks]**
14. What angle does it make with the three coordinates? **[2 marks]**
15. (i) Distinguish between mass and weight **[2 marks]**

(ii)A ball is dropped out of window on top of a building. If its acceleration

 towards the ground at a rate of 9.80 m/s2. What is its velocity after 4 meters.

1. (i) What are frictional forces? Classify friction between solids **[2 marks]**

(ii)Show that centripetal force is given by $F=\frac{MV^{2}}{r}$ **[2 marks]**

1. State the Pascal’s Principle **[2 marks]**

 A garage lift has input and lift pistons with a diameter of 10cm and 30cm respectively. The lift is used to hold up a car with a weight of $1.4×10^{4}N$

(i) What is the force on the input piston? **[2 marks]**

(ii) What pressure is applied to the input piston? **[2 marks]**

**QUESTION TWO**

1. (i) State the three fundamental laws of kinematics **[6 marks]**
2. Derive the following kinematic equations

$x=V\_{0}+\frac{1 }{2}at^{2}$ **[3 marks]**

$ V^{2}=V\_{0}+2ax$ **[3 marks]**

1. A force of 15.0 N is applied at angle of $30^{0}$ to the horizontal on a 0.75Kg block at rest on a frictionless surface as shown in fig.1.
2. What is the magnitude of the resulting acceleration of the block **[2 marks]**
3. If the force is applied for only 1.50sec. What happens after this **[2 marks]**
4. A boy on a bridge throws a stone vertically downwards towards the river below with an intial velocity of 14.7 m/s. if the stone hits the water 2.00 s later , what is the height of the bridge above the water? **[4 marks]**

 N

 $→$

 $→$

 $30^{0}$

 W

 Fig.1

 **QUESTION THREE**

1. For a projectile tracing a parabolic path. Derive the following

(i) Initial velocity components **[4 marks]**

(ii) Velocity components **[4 marks]**

(iii) Displacement components **[4 marks]**

1. A golf ball leaves the tee with an intial velocity of 30.0 m/s at an angle of 370 to the horizontal.

(i) What is the maximum height reached by the ball? **[4 marks]**

(ii) What is its range? **[4 marks]**

**QUESTION FOUR**

1. State the three Kepler’s laws **[6 marks]**
2. Derive the third law. **[6 marks]**
3. (i) If the coefficient of static friction between the 40 kg crate and the floor is

 0.650 with respect to the horizontal, what force should the worker apply to move the crate? **[4 marks]**

 (ii)If the worker maintains the force once the crate starts to move and the coefficient of

 kinematics between the surface is 0.500, What is the magnitude of acceleration of the

 crate? **[4 marks]**

**QUESTION FIVE**

1. Distinguish between elastic and inelastic collisions **[4 marks]**
2. A 1 kg with a speed of 4.5 m/s strikes a 2.0 kg stationary ball. If the collision is completely inelastic.
3. What are the speeds of the balls after collision? **[4 marks]**
4. What percentage of the initial kinetic energy do they have after collision?
5. State the work-energy theorem and show that it is given by $W\_{net}=∆K$ **[4 marks]**
6. A pool player pushes a 0.25 kg punk, initially at rest in a way that it causes constant horizontal forces of 6.0 N to act on it through a distance of 0.50m (neglect friction).
7. What are the kinetic and the speed of the punk when the force is removed **[4 marks]**

 (ii) How much work would be required to bring the punk at rest. **[4 marks]**