P425/1

APPLIED MATHEMATICS 2025

Paper 2

FEB/MARCH

TIME: $02\frac{1}{2}$ *Hours*

UGANDA ADVANCED CERTIFICATE OF EDUCATION

APPLIED MATHEMATICS

Paper Two (MECHANICS)

S.6 TEST ONE (LINEAR MOTION)

TIME: $02\frac{1}{2}$ *Hours*

INSTRUCTIONS TO CANDIDATES

- *Attempt **all** questions*
- *Only **neat** and **well-labelled** diagrams shall be marked.*
- *All your working **must** be shown clearly*
- *In numerical work, take **g** to be* $9.8ms^{-2}$ *unless otherwise.*

QUESTIONS (60 marks)

Answer **all** questions

1. *a) An over-loaded taxi travelling at a constant speed of* $90kmhr^{-1}$ *overtakes stationary Mitooma traffic police car. Two seconds later, the police car sets off in pursuit of the taxi accelerating at* $6ms^{-2}$. *Show that the distance the police car travels before catching up with the taxi is* $0.3km$ ***(06 marks)***

b) Two stones are thrown from the same point at the same time, one vertically upwards with a speed of $30ms^{-1}$ *and the other one vertically downwards at the same velocity. Find how far apart the stones are after* $3seconds$. ***(06 marks)***

2. *a) Two trains P and Q travel by the same route from rest at station A to rest at station B. train P has a constant acceleration* f *for the first third of the time, a constant speed for the second third and a constant retardation* f *for the last third of the time. Train Q has a constant acceleration* f *for the first third of the distance, constant speed for the second third and constant retardation* f *for the last third of the distance. Show that the times taken by the two trains are in the ratio* $3\sqrt{3}:5$. ***(08 marks)***

b) A driver of a car travelling at $72kmhr^{-1}$ *notices a tree which has fallen across the road,* $800m$ *ahead, and suddenly reduces speed to* $36kmhr^{-1}$ *by applying the brakes. Show that the driver applied brakes for* $53\frac{1}{3}seconds$ ***(04 marks)***

3. *a) A, B, C are the three points which lie in that order on a straight road with* $AB=95m\ and\ BC=80m$. *A car travels along the road in the direction ABC with a constant acceleration* ams^{-2}. *The car passes through A with speed* ums^{-1}, *reaches B five seconds later and C two seconds after that. Show that* $u=4ms^{-1}\ and\ a=6.0ms^{-2}$. ***(07 marks)***

b) A train was timed between three points A, B and C. it took $100 seconds$ *to move from A to B and* $150 seconds$ *to move from B to C. Given that* $AB = BC = 2km$, *show that the train stopped* $816\frac{2}{3}m$ *beyond C.* ***(05 marks)***

4. *a) A stone is dropped from the top of the tower. After one second, another stone is thrown vertically downwards from the same point at a speed of* $15ms^{-1}$. *If the stones reach the ground simultaneously, show that the height of the tower is* $18.49m$. ***(03 marks)***

b) A particle of mass 4kg moves such that $S = \begin{pmatrix} t^3 - t^2 - 4t + 3 \\ t^3 - 2t + 3t - 7 \end{pmatrix} m$

i. Calculate the times when the particle crosses the line $y = x$ ***(02 marks)***

ii. *Find the velocity of the particle at* $t = 4 seconds$ ***(04 marks)***

iii. Find the expression for acceleration in terms of t, *and hence calculate the force acting on the particle at* $t = \frac{2}{3} seconds$. ***(03 marks)***

5. *a) A vehicle travelling on a straight horizontal track joining two points A and B accelerates at a constant rate of* $0.25ms^{-2}$ *and decelerates at a constant rate of* $1ms^{-2}$. *It covers a distance of* $2.0km$ *from A to B by accelerating from rest to a speed* v, *and travelling at that speed until it starts to decelerate to rest. Show that the times taken for acceleration and deceleration are* $4v seconds$ *and* $v seconds$ *respectively. Given that the time take for the whole journey is* $2.5 minutes$, *show that the quadratic equation for the journey is* $v^2 - 60v + 800 = 0$, *determine* v, *explaining clearly the reason for your choice of the value of* v ***(07 marks)***

b) *A particle is projected upwards and* t *seconds afterwards, another particle is projected vertically upwards with the same initial velocity. Prove that the velocities when meeting will each be* $\frac{1}{2}gtms^{-1}$. ***(05 marks)***