DEPARTMENT OF MATHEMATICS

S.5 MATHEMATICS PAPER 2
(MECHANICS)

TIME: 1½ HOURS

INSTRUCTIONS

- Attempt **all** questions.

1. Given the vectors $\boldsymbol{a} = 2\boldsymbol{i} + 3\boldsymbol{j}$ and $\boldsymbol{b} = \boldsymbol{i} - 4\boldsymbol{j}$, find:
   (i) $|\boldsymbol{a} + \boldsymbol{b}|$ (03mks)
   (ii) $\boldsymbol{a} \cdot \boldsymbol{b}$ (02mks)
   (iii) angle between $\boldsymbol{a}$ and $\boldsymbol{b}$. (05mks)

2. The velocity of a particle is $\lambda i + 6j + k$ if its speed is $\sqrt{41}$, find the values of λ. (05mks)

3. A taxi accelerates uniformly from rest at $1ms^{-2}$. At the same time, a passenger who is 4m behind the taxi runs with constant speed after the taxi and just manages to catch up with it. Find the speed of the passenger. (09mks)

4. A particle moving with uniform acceleration of $1.25ms^{-2}$ passes through three points P, Q and R in a straight line. If $PQ = 95m$ and $QR = 90$ and the particle takes 30 seconds and 20 seconds to cover PQ and QR respectively, find the speed of the particle at P and its acceleration. (07mks)

5. Given the vectors $\boldsymbol{r} = 5\lambda\boldsymbol{i} + 4\boldsymbol{j} + 3\boldsymbol{k}$ and $\boldsymbol{t} = \boldsymbol{i} - 19\boldsymbol{j} + \lambda\boldsymbol{k}$. Find the value of λ if $\boldsymbol{r}$ and $\boldsymbol{t}$ are perpendicular. (04mks)

6. Three forces $F_1 = \begin{pmatrix} 1 \\ 4 \\ 9 \end{pmatrix} N$, $F_2 = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} N$ and $F_3 = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$.
   Find the:
   (i) resultant force and vector
   (ii) Angle between the resultant and vector $F_4 = \begin{pmatrix} 1 \\ -1 \\ 9 \end{pmatrix}$. (08mks)

7. A stone is thrown vertically upwards with a speed of $10ms$ from a point 5m above the ground. Find the time taken for the stone to hit the ground. (07mks)

END