Ans, $\vec{E} = E_0 \hat{z}$

$$\Rightarrow H' = -\int \vec{F}\cdot d\vec{r}$$

$$= -\int (-e E_0 \hat{z})\cdot d\vec{r} = e E_0 \int dz = e E_0 z$$

But $z = r\cos\theta$ = odd operator (Independent of ϕ)

Now, $\langle 0,0|H'|0,0\rangle = e E_0 \langle 00|z|00\rangle$

$$\left[\begin{matrix} l=0 & \text{S-State} \\ m=0 & \end{matrix}\right]$$

$$= e E_0 \langle 0|z|0\rangle \cdot \langle 0|0\rangle$$

($\because$ z is odd)

$$= 0$$

$\langle 0|z|0\rangle = 0$

$\langle 0|0\rangle = 1$

$$\langle 0,0|H'|1,1\rangle = eE_0 \langle 00|z|11\rangle = 0$$

$$= eE_0 \langle 0|z|1\rangle \underbrace{\langle 0|1\rangle}_{0}$$

$$\langle 00|H'|10\rangle = eE_0 \langle 00|z|10\rangle$$

$$= eE_0 \langle 0|z|1\rangle \underbrace{\langle 0|0\rangle}_{1}$$

$$= eE_0 \underbrace{\langle 0|z|1\rangle}_{\text{opposite parity}}$$

$$\neq 0$$

$\therefore$ (c) is correct option.