$E = \frac{m}{2}(\dot{r})^2$ and a circular orbit

$r = R$ will be possible if $E = 0$.

So we get a circular orbit when

$r = R$ and $L^2 = -2m\lambda \Rightarrow (mr^2\dot{\theta})^2 = -2m\lambda$

$$\Rightarrow \boxed{r = R \text{ and } \dot{\theta} = \pm\sqrt{\frac{-2\lambda}{mR^4}} \quad \Rightarrow \theta = \theta_0 \pm (t-t_0)\sqrt{\frac{-2\lambda}{mR^4}}}$$

Now suppose we perturb this orbit slightly. If we slightly change $\dot{\theta}$ or r, we get $V_{eff} \neq 0$ and the orbit wanders far from its circular shape.

If we keep $L^2 = -2m\lambda$ and only change $\dot{r}$, we have

$$E = \frac{m}{2}(\dot{r})^2 \Rightarrow \dot{r} = \pm\sqrt{2E/m}$$

$$\Rightarrow \boxed{r(t) = R \pm (t-t_0)\sqrt{2E/m}}$$

Again the orbit does not stay near