In this work we will treat the spurious eigenvalues obstacle that appears in the computation of the radial Dirac eigenvalue problem using numerical methods. The treatment of the spurious solution is based on applying Petrov-Galerkin finite element method. The significance of this work is the employment of just continuous basis functions, thus the need of a continuous function which has a continuous first derivative as a basis is no longer required. The Petrov-Galerkin finite element method for the Dirac eigenvalue problem strongly depends on a stability parameter, $\tau$, that controls the size of the diffusion terms added to the finite element formulation for the problem. The mesh-dependent parameter $\tau$ is derived based on the given problem with the particular basis functions.