What is the difference between Eulerian and Lagrangian perturbation? What is the theory of small perturbations? Establish the equations for adiabatic oscillations. In connection with the Sturm-Liouville problem, characterize the main properties of the spectrum of stellar oscillation modes.

Starting from the equations for non-radial adiabatic oscillations, demonstrate that the separation of variables is possible with spherical harmonics. Introduce the critical frequencies of Brunt-Vaisala and Lamb and explain their impact on the behavior of the eigenfunctions (propagation diagram). What is a mixed mode?

Describe and justify the asymptotic behavior of frequencies in a semi-open organ pipe and describe them for the p and g modes of a star. On this basis, introduce the main seismic indicators for p- and g-modes and explain the information on the internal structure they provide.

State the variational principle for stellar oscillations and for a semi-open organ pipe. Based on it, explain and justify the 1st order effect of rotation on frequencies and explain what are seismic inversions.

Introduce the 3 zones of a star from the point of view of adiabaticity. Establish the integral relation giving the growth rate of radial modes and interpret it (link with Carnot cycles). On this basis, explain the kappa mechanism and the radiative damping mechanism. What can be learned about the stars with non-adiabatic asteroseismology?