Galaxies final exam II, course 2004-2005

Please write down you name and your student ID on every page. You can use English or Dutch. Make your exam readable, and explain clearly all the steps you have used to derive a certain result.

1. Assume that the gravitational potential of a system is $\Phi(r) = -V_C^2 \log(1 + r/r_c)$. Derive the (volume) density, the circular velocity and show that the total mass of this system is infinite. Recall that $\nabla^2 f = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 \frac{\partial f}{\partial r}) + \frac{1}{r^2 \sin\theta}\frac{\partial}{\partial \theta}(\sin\theta \frac{\partial f}{\partial \theta}) + \frac{1}{r^2 \sin\theta^2}\frac{\partial^2 f}{\partial \phi^2}$

2. Interpreting the colours and spectra of galaxies

   (a) You observe that a nearby galaxy is extremely blue. However, it shows not sign of recent star formation. What is your interpretation of why the stars in this galaxy are so blue?

   (b) You measure the spectrum of a galaxy and note that it has absorption line features similar to a K-giant star. Why does that imply that the galaxy formed most of its stars more than 10 Gyr ago?

   (c) Draw and label a plot of a possible isochrone for stars which make up the galaxy in (b)

   (d) Was this galaxy brighter or dimmer in the past? Why?

3. Describe a method that could be used to determine the distance to the Magellanic clouds. Mention whether this method relies on absolute or relative distance indicators. If the latter is the case, what intermediate steps are used to compute the distance?

4. Explain how we know that the Milky Way galaxy is a disk (spiral) galaxy. Use in your explanation the concept of star-counts, mention the tracers of the spiral arms. Is the Galactic disk rotating as a rigid-body? Describe which observations can be used to determine the answer to this question.

5. Elaborate on a topic of your choice that has been discussed in the lectures. Try not to use more than 1 page.