# Information regarding PHY-305A: Physics of the Universe

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The course titled **Physics of the Universe** is a multidisciplinary course. It has to be multidisciplinary as it involves laws of quantum mechanics, thermodynamics, statistical mechanics, Newtonian theory of gravity and special theory of relativity in various forms. In this course we do not use laws of general theory of relativity although we do study basic cosmology at the end of the course. It is ideally suited for students who have a keen interest in physics and want to unravel the mysteries of the universe. Although we have specified various disciplines of physics we will not use all of the above subjects very deeply, except Newtonian gravity. The backbone of the course will be Newtonian gravity.

The course starts with basic understanding of quantum laws and laws of statistical physics. These laws will be applied to understand the observational methods in astrophysics. Then we will use these laws to understand the dynamics of stellar evolution. We will briefly touch various aspects in stellar evolution. From stars we will move over to galaxies in the middle of the course. The emphasize will be on virial theorem and its applications. We will try to formulate some basic understanding of galaxies and briefly introduce the subject of dark matter. After the formal study of galaxies we will try to formulate cosmology, using Newtonian physics. Once we formulate cosmological equations we will try to apply them to understand the universe in the largest length (and time) scales.

As because the course is multidisciplinary and involves various branches of physics, I strongly recommend the students to attend all the classes in this course. If you miss a class it will be difficult for you to make it up as the course is of a new type, compared to other conventional courses given. There will be homeworks which will complement the course. The homeworks will be elaborate and will contain various hints such that you can do them on your own. The homeworks must be done seriously as questions in the examinations may require their knowledge.

The study material of the course work includes:

- **Physical universe, an introduction to astronomy** by Frank H. Shu
- **Galactic dynamics** by Binney and Tremaine
- **Concepts of modern physics** by Arthur Beiser (As a general reference)

There will be two quizzes in the course except the standard examinations. The quizzes will be of ten and twenty marks. The first one will be before midsem and the second one before endsem.

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