PHY7092 : Physical Cosmology

Programme: M.Sc. (Physics). Year: 2nd Semester: 4th
Course : Elective Credits : 4 Hours : 60h

Course Context and Overview (100 words):

Students will learn to use a fundamental physical approach to understanding the Universe at large.

Prerequisites Courses:

None

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 Use mathematical and physical principles to describe the laws governing the Universe.
C02 Use the General Theory of Relativity to describe and understand the dynamics of space-time.
C03 Use the geometry and dynamics of space-time to understand the evolution of the Universe, the age of the Universe and Dark Energy which is the dominant component of the energy density of the Universe.
C04 Use Thermodynamics to understand the number density, energy density and pressure of particles in the cosmos.
C05 Use the standard model of particle physics and its implications to understand the history of the universe.

Course Topics:

	Topics	**Lecture Hours**
1.	**Unit I: General Introduction and the Key Observational Facts about the Universe**	**5**
2.	**Unit II: Dynamics and Geometry of Space-Time: The General Theory of Relativity: metric tensor, connection coefficients, curvature of space-time, Einstein Equation.**	**10**
3.	**Unit III: Modern Cosmology and Dark Energy: Space-Time for Cosmology, the Friedmann- Robertson-Walker (FRW) Metric, Time Evolution for Cosmology and the Friedmann Equations, Expansion Age of the Universe and Dark Energy.**	**10**

4. Unit IV: Thermodynamics: From first principles to the number density, energy density and pressure of particles in the cosmic soup	**5**
5. Unit V: Thermal History of the Universe: brief introduction to the standard model of particle physics and its implications for the history of the universe	**5**
6. Unit VI: Structure Formation in the Universe	**5**

In addition to this there will be a project that students will have to complete.

Textbook references (IEEE format):
Text Book:

The Early Universe, by E. W. Kolb and M.S. Turner.

Reference books:

Gravitation and Cosmology, by S. Weinberg

The Classical Theory of Fields by L. Landau and E. Lifshitz.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Activities	**Percentage**
Mid Sem Exam	**30**
Class Participation and Project	**10**
End Sem Exam	**60**
Total	**100**

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Last Update: _____