강 의 계 획 서(Syllabus)

[1] 기본 정보(Basic Information)

■ 강의 정보(Course Information)

교과목명 (Course Title)	상대론과 우주(RELATIVITY AND UNIVERSE)	강의유형 (Course Type)	이론(Theoretical course)

[2] 학습 목표/성과(Learning Objectives/Outcomes)

■ 과목 설명(Course Description)

Introduction to special relativity and calculation tools with vector and tensor quantities are given. Tensor algebra on curved space and covariant derivatives are constructed. Riemannian manifold and curvature tensor are discussed. Motion of particles in curved spacetime is dealth with. Einstein field equations and its weak field limit are discussed and gravitational waves and its detection are addressed. Spherical solutions to Einstein field equations are obtained and applied to Schwarzshild black holes. Finally, applications of general relativity to the early Universe and cosmological evolution are discussed.

■ 학습 목표(Learning Objectives)

The lecture is to start from a review on special relativity and its limitation and aim at the acquiantance of new concepts in general relativity. Tools for describing the motion of particles in curved spacetime are presented in terms of generalized tensor analysis in curved spacetime. Applications are made to realistic cases such as stars and black holes and cosmological evolution.

■ 학습 성과(Learning Outcomes)

Students become familiar with special relativity and differential geometry in curved spacetime and apply them to describe general geometries in Einstein's gravity.

[3] 강의 진행 정보(Course Methods)

■ 강의 진행 방식(Teaching and Learning Methods)

강의 진행 방식	추가 설명
강의(Lecture)	White board is used to deliver basic concepts and applications of general relativity.
중간시험(Mid-term Exam)	Midterm exam will be taken.
기말시험(Mid-term Exam)	Endterm exam wii be taken.

■ 수업 자료(Textbooks, Reading, and other Materials)

수업 자료	제목	저자	출판일/게재일	출판사/학회지
주교재(main textbook)	A first course in general relativity	Bernarde Schutz	2009	Cambridge University Press
참고도서(Reference)	An introduction to general relativity: Spacetime and geometry	Sean M. Carroll	2004	Addison Wesley

참고도서(Reference)	The Early Universe	R. Kolb, M. Turner	1990	Addison-Wesley Publishing Company
참고도서(Reference)	Gravity: An Introduction to Einstein's General Relativity	James B. Hartle	2003	Pearson

[4] 수업 일정(Course Schedule)

차시	강사명	수업주제 및 내용	제출 과제	추가 설명
1	이현민	Special Relativity I		Introduction to SR
2	이현민	Special Relativity II	HW #1	Operations of vector and tensor products in SR.
3	이현민	Curvature I		Tensor algebra and calculus in polar coordinates.
4	이현민	Curvature II	HW #2	Christoffel symbols and the metric.
5	이현민	Curved manifolds I		Riemannian manifold, Covariant derivative.
6	이현민	Curved manifolds II	HW #3	Curvature tensor and its properties.
7	이현민	Physics in a curved spacetime		Motion of particles in curved spacetime.
8	이현민	Midterm exam		
9	이현민	Einstein field equations		Einstein equation and weak-field limit.
10	이현민	Spherical solutions for stars	HW #4	Spherical solutions to Einstein equation.
11	이현민	Schwarzschild black holes		Trajectories in Schwarzschild black hole.
12	이현민	Cosmology I	HW #5	Friedman-Robertson-Walker metric.
13	이현민	Cosmology II		Cosmological dynamics.
14	이현민	Cosmology III	HW #6	Equilibrium dynamics.
15	이현민	Gravitational waves		Gravitational waves, its detection and generation.
16	이현민	Final exam		

[5] 수강생 학습 안내 사항
Lectures are based on an introductory textbook for general relativity at advanced undergraduate level. It is recommended to have a textbook for this lecture, but lectures will cover most of contents in the textbook.