

# GENERAL RELATIVITY

1	Course Title:	GENERAL RELATIVITY	
2	Course Code:	FZK6110	
3	Type of Course:	Optional	
4	Level of Course:	Third Cycle	
5	Year of Study:	1	
6	Semester:	2	
7	ECTS Credits Allocated:	6.00	
8	Theoretical (hour/week):	3.00	
9	Practice (hour/week):	0.00	
10	Laboratory (hour/week):	0	
11	Prerequisites:		
12	Language:	Turkish	
13	Mode of Delivery:	Face to face	
14	Course Coordinator:	Doç. Dr. Cem Salih Ün	
15	Course Lecturers:	Doç. Dr. Cem Salih ÜN, Dr. Öğr. Gör. Zerrin KIRCA	
16	Contact information of the Course Coordinator:	Doç Dr. Cem Salih ÜN, Email: cemsalihun@uludag.edu.tr Tel: 0224-2955075	
17	Website:		
18	Objective of the Course:	The aim of this course is to provide information about basic concepts and mathematical structure of general relativity.	
19	Contribution of the Course to Professional Development:	The student can understand and interpret the current developments in theoretical and experimental general relativity. Besides, they can theoretically explain the experimental observations.	
20	Learning Outcomes:		
		1	To learn the basic conceptual foundations of the general relativity.
		2	To learn mathematical structure of the general relativity
		3	To learn experimental tests of the general relativity and standard cosmological models.
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21	Course Content:		
		<b>Course Content:</b>	
Week	Theoretical	Practice	
1	Special relativity, Lorentz transformations, spacetime diagrams, vectors and tensors		
2	Special relativity; Proper time, Physics in flat spacetime		
3	Manifolds; Coordinate systems, vectors, tensor transformation law		

4	Manifolds; metric, tensor densities	
5	Curvature; Covariant derivatives and connection coefficients, Parallel transport, geodesics, Riemann tensors	
6	Gravitation; the principle of equivalence, Einstein's equations, the Newtonian limit	
7	Weak fields and gravational radiation; the weak field limit	
8	Weak fields and gravational radiation; Linearized Einstein equations, gravitational waves	
9	The Schwarzschild solution and black holes; Birkoff's theorem, geodesics of Schwarzschild , Kruskal expansion	
10	The Schwarzschild solution and black holes; Penrose diagrams, Black-hole thermodynamics	
11	The Schwarzschild solution and black holes; Black-hole thermodynamics (Contiune)	
12	Cosmology; Robertson-Walker metric, The Friedmann equations	
13	Cosmology; Cosmological redshift, inflation	
14	Cosmological models	

<b>22</b>	Textbooks, References and/or Other Materials:	1. General theory of relativity by P. A. M. Dirac. 2. Schwarzschild and Kerr Solutions of Einstein's Field		
Activities		Number	Duration (hour)	Total Work Load (hour)
Theoretical		14	3.00	42.00
		1. General Covariance and The Foundation of General Relativity by L. D. Norton		
Practicals/Labs		0	0.00	0.00
Self study and preparation		6	6.00	36.00
		4. Black Holes and Time Warps by K. S. Thorne		
Homeworks		14	4.00	56.00
TERM LEARNING ACTIVITIES	NUMBER	WEIGHT		
Projects	0	0.00	0.00	0.00
Field Studies		0	0.00	0.00
Mid-term exams	0	0.00	2.00	2.00
Quiz				
Others		0	0.00	0.00
Final Exams	1	50.00	2.00	2.00
Total Work Load				188.00
Total work load/ 30 hr				
Contribution of Term (Year) Learning Activities to		50.00		6.20
ECTS Credit of the Course				6.00
Contribution of Final Exam to Success Grade		50.00		
Total		100.00		
Measurement and Evaluation Techniques Used in the Course		The system of relative evaluation is applied.		

24	ECTS / WORK LOAD TABLE
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ÖK2	5	3	3	5	3	3	0	0	0	0	0	0	0	0	0	0
ÖK3	5	3	3	5	3	3	0	0	0	0	0	0	0	0	0	0
LO: Learning Objectives    PQ: Program Qualifications																
Contribution Level:	1 very low			2 low			3 Medium			4 High			5 Very High			