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:		

Course Content:

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 equivalance, 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	

22	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 Equation: an introduction by C. Heinicke, F. W. Hehnl 3. Spacetime Geometry and General Relativity by N. Lambert 4. General Covariance and The Foundations of General Relativity by J. D. Norton 5. General Relativity by B. Crowell 6. Black Holes and Time Warps by K. S. Thorne
23	Assesment	

TERM LEARNING ACTIVITIES	**NUMBER**	**WEIGHT**
Midterm Exam	1	25.00
Quiz	0	0.00
Home work-project	1	25.00
Final Exam	1	50.00
Total	3	100.00
Contribution of Term (Year) Learning Activities to Success Grade		50.00
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**

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	3.00	42.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	14	6.00	84.00
Homeworks	14	4.00	56.00
Projects	0	0.00	0.00
Field Studies	0	0.00	0.00
Midterm exams	1	2.00	2.00
Others	0	0.00	0.00
Final Exams	1	2.00	2.00
Total Work Load			188.00
Total work load/ 30 hr			6.20
ECTS Credit of the Course			6.00

25	**CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS**															
	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	5	3	3	5	3	3	0	0	0	0	0	0	0	0	0	0
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**