

Name: Enrolment No:	
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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: RELATIVITY AND COSMOLOGY	Semester : II
Program: M.Sc PHYSICS	Time : 03 hrs.
Course Code: PHYS 7019	Max. Marks : 100

Instructions:

SECTION A
(5Qx4M= 20 Marks)

S. No.		Marks	CO
Q 1	If the Earth is rotating (and the sun is not) the speed at the Earth's equator is about 1000 mi/hr, but there are no thousand mile-per-hour winds at the equator because..... Complete this appropriately. (Hint: one of the following may help your argument!) a) The atmosphere rotates with the Earth b) Gravity does not pull on the atmosphere so it just stays put c) There <i>are</i> such winds, but only at the North and South poles d) The solar attraction produces an equal and opposite wind	4	CO1
Q 2	When Ravish left on a long trip to a near-by star he was 20 years old. He clocked the trip as taking 5 years. In case you are curious his speed was 99.61% that of light. Which birthday did his twin, Rakesh, celebrate on the day Ravish came back?	4	CO1
Q 3	What is parallel transport in a manifold (geometry)?	4	CO2
Q 4	What are non-Euclidean spaces?	4	CO2
Q 5	What are Schwarzschild's and Kerr's Black holes?	4	CO3

SECTION B
(4Qx10M= 40 Marks)

Q 6	What are 4-vectors? Elaborate on Contravariant and Covariant vectors.	4+6	CO2
Q 7	Analyze inertial and gravitational accelerations. Can you compare them?	8+2	CO2
Q 8	What is Cosmological Red Shift? Discuss its implication on the understanding of our universe.	4+6	CO4
Q 9	State and analyze the Steady State theory of our universe.	10	CO4

	OR		
	Examine and describe ‘Nucleosynthesis’, i.e., the process of creation of nuclei beyond the lightest ones in our universe.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	After Einstein, Minkowski propounded his 4-D formulation. Analyze the formulation in detail and re-create the ‘world view’. Compare the phrases ‘Spacetime’ and ‘Space and Time’.	15+5	CO1
Q 11	Stars are like living beings; they are born, they grow and evolve and they die! Considering the underlying principles of physics, create the entire life cycle of massive stars, those that lead to formation of neutron stars. OR What are low, medium and high mass stars? Create the life cycle of medium and low mass stars based on the underlying principles of physics.	20	CO3