


Name:			
Enrolment No:			
UPES End Semester Examination, December 2024			
Course: Space Science and Space Environment Program: B. Tech ASE Course Code: ASEG3033P		Semester : V Time : 03 hrs. Max. Marks: 100	
Instructions: Brief and to-the-point answers are expected. Assume suitable data if needed.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	State the role of the Van Allen belts in Earth's magnetosphere.	4	CO3
2	Explain how the solar wind affects the magnetosphere.	4	C03
3	State the difference between the Big Crunch and the Big Freeze theories.	4	C04
4	Differentiate between white dwarfs, neutron stars, and black holes in terms of density and composition.	4	C01
5	Why is the study of astronautics important for human space exploration with suitable example.	4	C02
SECTION B (4Qx10M= 40 Marks)			
Q 6	a) Compare the characteristics of the heliosphere and the magnetosphere. [05] b) Describe the shape of the heliosphere and the role of the termination shock.[05]	10	CO3
7	a) Define the cosmic horizon and its significance in the observable universe.[05] b) Explain the role of weak lensing in studying dark matter.[05]	10	CO3
8	a) Investigate the role of supernovas in the formation of neutron stars and black holes. [05] b) Assess the importance of the Chandrasekhar limit in predicting the fate of stars. [05]	10	C02
9	Derive the mathematical expression for the Lorentz force.	10	C01
OR			

	Analyze the interaction between Earth's magnetic field and the Lorentz force in creating auroras with a neat sketch.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	<p style="text-align: center;">Case Study</p> <p style="text-align: center;">The Big Bang, Superstring Theory Theory</p> <p>The path to the origin of life on Earth commenced with a dense, compact, hot universe that, with a Big Bang event, expanded, forming elements heavier than hydrogen at a high temperature, followed by gradual cooling of the universe. At this point it is hypothesized that a singular force was present that separated into the four known forces: gravity, electro-magnetism, strong nuclear and weak nuclear. Gravity became a recognizable singular force as objects took on the property of mass throughout the universe. The weak and strong nuclear forces were also a property of the elements and compounds making up mass. The weak nuclear force (short range) causes the conversion of a neutron to a proton, and an electron and antineutrino with decay being a weak interaction. The strong nuclear force binds neutrons and protons together in atoms, and is also a short-range force. The electro-magnetic force acts between electrically charged particles. Electricity, magnetism and light are produced by this force</p> <p>However, the initial state, size and location of the universe prior to the expansion event are unknown. Hence, there is no known scientific explanation for the origin of the universe prior to the expansion event nor present capability to detect the exact origin of the universe. Moreover, the concept of time may not have any meaning before the Big Bang expansion event. Time (if it exists) moves forward at the instance the expansion event occurred. The rate of expansion after an initial rapid phase entered a slower phase of universal expansion. It is interesting to speculate if and when the expansion phase stops, will the universe condense and form a dense, hot spot where the four forces reunite and once again be capable of a Big Bang followed by the origin of life again with the capacity to evolve into diverse complex life forms? Or will gravity be sufficient to keep bodies in the universe away from each other? Maybe the Big Bang has occurred before and our living biosphere on the Earth is not the first biosphere that has been present in the universe. Rewinding the tape of the universe and playing it again is interesting to consider. Would the same events occur in the same order and times or would the events and times be different every time the tape was rewound and replayed.</p> <p>Superstring Theory and the origin of life- Life is a self-replicating, evolving system based on organic chemistry/biochemistry in a physical–chemical</p>	20	CO4

	<p>environment. The prime function of life is to make more life of a specific composition . The extraterrestrial origin of life and its subsequent delivery to the Earth, billions of years ago will not be discussed in this article, even though it might have been possible.</p> <p>Regardless of the location where life originated, living organisms obey the three Laws of Thermodynamics and originated and evolved dependent on the four known forces in the universe. The four known forces were all present when life assembled or originated on the Earth (or elsewhere). What roles did they have in the assembly of the first pre-cells and then cells capable of growth and cell division on the early Earth? If the singular initial unified force had not separated into four distinct singular forces after the Big Bang, life would not have assembled on the Earth and our common global biosphere would not be present.</p> <ol style="list-style-type: none"> 1. What are the four fundamental forces in the universe, and what role does each play in the physical and chemical processes. [03] 2. Explain how the separation of the unified force into the four known forces contributed to the possibility of life’s assembly. [04] 3. Compare the roles of gravity and the electromagnetic force in the formation of the early universe and the conditions for life. [06] 4. Critically evaluate the hypothesis that life could not have formed without the separation of the unified force into the four fundamental forces. Provide scientific reasoning for your evaluation. [07] 		
11	<ol style="list-style-type: none"> a) Analyze the role of Coriolis force in the formation of cyclones illustrate with neat sketch with suitable example.[10] b) Explain the formation of a supermassive black hole and its property. [10] <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> c) Justify why black holes are considered the endpoint of stellar evolution for massive stars.[10] d) Develop a timeline diagram showing the key events from the Big Bang to the present. [10] 	20	CO2