

23U610

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Name:

Reg.No:

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2026

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19UPHY6B13 / CC20UPHY6B13 - RELATIVISTIC MECHANICS AND ASTROPHYSICS

(Physics - Core Course)

(2019 Admission onwards)

Time : 2.00 Hours

Maximum : 60 Marks

Credit : 3

Part A (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. State the postulates of special theory of relativity.
2. Give the equations of Lorentz transformation.
3. What is meant by simultaneity? How does the status of simultaneity change in relativistic and non-relativistic physics?
4. What is proper time interval?
5. Write Einstein's field equation.
6. Schwarzschild radius is often called the event horizon. Why?
7. How size of star can be measured?
8. Distinguish between luminosity and flux of stars.
9. What is an galactic/open cluster? Give an example.
10. What is a pulsating variable star?
11. What is the relation between size and period of a Cepheid?
12. What is meant by singularity?

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. A spacecraft is moving at $0.40c$ with respect to the earth. If another spacecraft is to pass the first one at a relative speed of $0.10c$ in the same direction, what speed must the second spacecraft have with respect to the earth?

14. Let the angle between the direction of motion of a light source (of frequency ν_0) and the direction from it to an observer is θ . What is the frequency as observed by the observer?
15. Describe the experiment used to verify velocity dependence of mass of a particle.
16. Two grams of helium are completely converted into energy and used to power a 5000kg vehicle. If all of this energy is converted into kinetic energy of the vehicle, how fast will the vehicle move?
17. What is Cosmic Microwave Background Radiation (CMBR)? How does it support the Big bang theory?
18. Explain the features of Hydrogen atom spectrum. How stars are classified based on spectra?
19. Determine the main-sequence lifetime of Sirius, which has a mass of $2.12 M_{\odot}$,

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any **one** question. The question carries 10 marks.

20. Discuss the internal structure of the Sun and describe how energy is transported from core to the surface.
21. What are galaxies? Classify different type of galaxies. Describe the "structure of spiral galaxy? Discuss the factors, which affect the observation of galaxies."

(1 × 10 = 10 Marks)
