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Deemed- to -be -University under Section 3 of the UGC Act, 1956

DEPARTMENT OF SCIENCES M.Sc (Physics) - IV SEMESTER END SEMESTER EXAMINATION, APRIL 2017 SUBJECT: Relativity and Astrophysics [PHY 704] (REVISED CREDIT SYSTEM)

Time: 3 Hours

MAX. MARKS: 50

Answer any 5 full questions

- 1(a) Obtain Lorentz transformation equations for space and time co-ordinates (5 Marks)
- 1 (b) Show that geodesic on a spherical surface is a great circle (5 Marks)
- 2 (a) An electron with kinetic energy 1MeV collides with a stationary positron. Two particles are annihilated to produce two γ rays of equal energy, each moving at equal angle θ with respect to electron's direction of motion. Find energy, momentum and angle θ of the γ rays (5 Marks)
- **2 (b)** Describe energy generation in stars through proton-proton chain, CNO cycle and triple alpha reactions (**5 Marks**)
- **3 (a)** Describe (qualitatively) Schwarzschild solution to Einstein's field equation. Explain how it predicts the existence of black holes (**3Marks**)
- **3 (b)** Show that 4 vector dot product of 4-momentum is invariant under Lorentz transformation (**2 Marks**)
- **3(c)** Show that geodesic is an auto parallel curve (**5 Marks**)
- **4(a)** Differentiate between apparent and absolute magnitudes of stars. If two stars have absolute magnitudes of 6 and 26, find the ratio of luminosities (**5Marks**)
- 4(b) Obtain expressions for Jeans mass and Jeans length of interstellar cloud (5 Marks)
- **5** (a) Describe the formation of type I and type II supernovae (**3 Marks**)
- 5 (b) Explain Hubble's law (2 Marks)
- **5** (c) Differentiate between red giant stage of low mass and high mass stars. Describe the structure of a red super giant star (**5 marks**)
- **6** (a) Briefly describe big bang and the early stage of universe (**5** Marks)
- **6 (b)** Obtain expression for relativistic Doppler shift (**3 Marks**)
- **6** (c) Obtain components of energy-momentum tensor (2 Marks)