LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - PHYSICS
THIRD SEMESTER – NOVEMBER 2011
PH 3952 - GRAVITATION AND COSMOLOGY

Date : 08-11-2011   Dept. No.   Max. : 100 Marks
Time : 9:00 - 12:00

PART – A

Answer **ALL** the questions   (10 X 2 = 20)

1. What are the two approaches to General Relativity ?

2. Give the transformation law for a contravariant tensor of rank n.

3. What is a geodesic ? Name the types of geodesics.

4. What is an affine parameter ?

5. What are photon orbits ?

6. Define gravitational red shift.

7. Define binding energy of a compact spherical object.

8. What is a QSO?

9. State Hubble's law.

10. What is CMBR ?

PART – B

Answer any **FOUR** questions   (4 X 7.5 =30)

11. Illustrate with an example the idea that gravitational effects can be described through the non-Euclidean nature of the space-time geometry.

12. Show that the metric tensor element g_{44} may be connected to the Newtonian gravitation potential.

13. Estimate the net deflection of a light ray in the Sun's gravitational field using the general theory of relativity.

14. Explain the gravitational collapse of a homogeneous dust ball.

15. How is the age of the Universe estimated ?

PART – C

Answer any **FOUR** questions   (4 X 12.5 =50)

16. (a) Explain why Newtonian gravitation is considered unsatisfactory in the framework of modern theoretical physics.

    (b) Discuss Mach principle.

17. (a) Explain the role of the Riemannian tensor in describing the geometrical properties of space-time.

(b) Discuss the importance of energy-momentum tensors in general theory of relativity.

18. (a) How is Mossbauer effect used to measure gravitational red shift in a terrestrial experiment?

    (b) Describe Everitt's experiment regarding the precession of a gyroscope.

19. Discuss the equilibrium of a massive spherical object using the Schwarzschild interior solution.

20. (a)Explain the significance of the microwave background radiation.

    (b) Discuss Olber's paradox and how it is resolved.

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