 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **PHYSICS**

THIRD SEMESTER – **APRIL 2012**

# PH 3952 - GRAVITATION AND COSMOLOGY

Date : 28-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART - A**

Answer **ALL** questions (10x2=20)

1. What are the desirable features of a theory of gravitation?
2. State Mach principle.
3. Define Ricci tensor.
4. When is an affine connection said to be Riemannian?
5. State Birkhoff theorem.
6. What is Thomas precession?
7. Define nucleonic mass of a compact spherical object.
8. When does the general relativistic contribution to the binding energy of a QSO become significant?
9. State Hubble’s law.
10. State the cosmological principle.

**PART - B**

Answer any **FOUR** questions (4x7.5 = 30)

1. Explain why Newtonian gravitation is considered unsatisfactory in the framework of modern theoretical physics.

12 Discuss the role of energy-momentum tensors in general theory of relativity.

13 Derive the most general spherically symmetric line element.

14 Show that in the extremely dense state of nuclear density the nucleonic mass which can be supported in equilibrium is less than 3 solar masses.

15 Explain Olber’s paradox. How is it resolved?

**PART - C**

Answer any **FOUR** questions (4x12.5 =50)

16. (a) Explain and interpret the Lie derivative of A along B , where A and B are two vector fields.

(b) Show that the Christofel symbols do not transform like a tensor.

17. (a) Explain the two important properties of a geodesic.

(b) Obtain the equation for a geodesic.

18. (a) Discuss particle orbits in the Schwarzschild space-time using Newtonian approximation.

(b) Calculate the radar echo delay due to the Sun’s gravitational field.

19. (a) Discuss the Schwarzschild solution of Einstein’s equation and obtain the exterior Schwarzschild metric.

(b) Discuss Fowler’s theory of a QSO.

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

(b) Discuss the observational background of cosmology.

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