THIRD SEMESTER M.Sc. DEGREE EXAMINATION, FEBRUARY 2008
Physics
PHY 304- ELEMENTARY PARTICLES AND ASTROPHYSICS
(2003 admissions)

Time : Three Hours   Maximum : 80 Marks

Section A

Answer any **five** questions.
Each question carries 4 marks.

1. Mention the interacting particles and mediating particles in each of the basics forces of nature. What is the spin of the mediating particles?

2. "A different flavour of neutrino is paired with each flavour of charged lepton". Explain.

3. What is parity? Show that the eigen value of the parity operator is +1.

4. What are particle resonances? How are they produced?

5. What is colour index of a star? Does it vary with the distance of the star?

6. Briefly explain the HR diagram.

7. Explain the phenomenon of helium flash during stellar evolution.

8. What do you mean by event horizon of a black hole?

[5 x 4 = 20 marks]

Section B

Answer any **two** questions.
Each question carries 20 marks

9. (a) (i) Describe the Yokawa theory and explain how it load to the discovery of the meson.

   (ii) *"CP violation implies T violation through CPT theorem"*. Discuss.

Or

   (b) (i) Describe the six quark flavors. Hence explain the quark model of hadrons.

   (ii) What do you mean by *infrared slavery and ultraviolet freedom* of quarks?

10. (a) (i) Explain the parallax method of determining stellar distances.

   (ii) Discuss Saha's theory of thermal ionization.

Or

(b) (i) Discuss with necessary theory, the energy transport in stellar interiors.

(ii) Outline the evolution of a main sequence star.

[2 x 20 = 40 marks]

Section C

Answer any **two** questions.
Each question carries 10 marks

11. Using the values of the quantum numbers B, S and I_3 of quarks, obtain the charge on each of the members of the J= $\dfrac{3}{2}$ baryon decouplet.

12. Find the ratio $\dfrac{\sigma(i)}{\sigma(ii)}$ of the cross sections of the following reactions by considering the isospin channel through which they proceed.

$$p + p \rightarrow d + \pi^0 \ \ldots\ldots\ldots\ldots\ldots\ldots(i)$$
$$p + n \rightarrow d + \pi^0 \ \ldots\ldots\ldots\ldots\ldots\ldots..(ii)$$
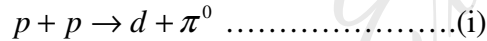
13. (a) A visual binary star has a parallax of 0".025 and angular the angular distance between the component stars is 2".5. Calculate the linear distance between the two members of the binary.

(b) The apparent magnitude of a star is observed to be +3.3 and its parallax is 0".025. Find the absolute magnitude of the star.

14. (a) Compute the proportion of neutral aluminium in an atmosphere of T = 6000 K, P_e =300 dyne cm^2. For aluminium, $\log \dfrac{2u_1}{u_0} = 0.34$.

(b) Calculate the rotational energy of a neutron star of 1 M_{Θ} and 10 km radius, having a period of 100 ms. If the observed fractional slow-down rate of this pulsar is 10^{-12}, calculate its rotational energy loss.

[2 x 10 = 20 marks]