EX/M.SC./PHY/E/III/114/29/2017

MASTER OF SCIENCE EXAMINATION,2017
(3RD YEAR ,1ST SEMESTER,EVENING)
PHYSICS
NUCLEAR & PARTICLE PHYSICS
PHY/TG/114

Time: Two hours Full Marks:40

Answer any four questions from question no.1 to 7 and any two from the rest

1. Discuss the characteristics of strong and weak interaction with relevant Feynman diagram.Calculate the range of the interaction when the mass of the mediator is 140 Mev. 3+1

2. a). Write the expression for the QCD coupling constant. How does it explain the asymptotic freedom?
   b).Two non strange baryons have iso-spin projections + 1/2 and +3/2 respectively. What would be the charge of the particles? Identify the particles. 2+2

3. What are characteristics of strange particles?
   State with reason whether the following decays are allowed or not:
   i) $\pi^- + P^+ \rightarrow K^0 + \pi^0$
   ii) $\Sigma^0 \rightarrow \Lambda^0 + \gamma$ 2+2

4. What is range of an alpha particle? On which factors does it depend? Compare the ranges of two alpha particles moving in air with energies 4MeV and 9MeV. 1+1+2

5. What do you mean by hindrance factor and what is its origin? How does it change the alpha decay constant as predicted by Gamow's theory? 3+1

6. Photoelectric effect will be more effective in lead than copper for gamma attenuation-justify. Demonstrate the variation of photoelectric and pair production cross section with energy. 2+2

7. Briefly describe how nuclear polarization was achieved in Wu's experiment. Which observed feature of the experiment demonstrated the violation of parity in beta decay? 3+1

8. Why deuteron is supposed to be exist in admixture state of $^3S_1$ and $^3D_1$ states? Show that deuteron cannot exist in excited state. 2+10

9. Find the probability of emission of beta particles in a specified momentum range per unit time neglecting coulomb interaction of the beta particles with the nucleus. Draw the corresponding momentum spectrum. How does it change due to the introduction of coulomb correction factor? 10+1+1

10. Write notes on 6+6
    a) Low energy n-p scattering and Fermi scattering length.
    b) Semi-empirical mass formula for atomic nuclei