Examination: B.S. 4 Years Program

PAPER: Particle Physics-I
Course Code: PHY-407   Part–I (Compulsory)

MAX. TIME: 15 Min.
MAX. MARKS: 10

Signature of Supdt.:

Attempt this Paper on this Question Sheet only.
Please encircle the correct option. Division of marks is given in front of each question.
This Paper will be collected back after expiry of time limit mentioned above.

Question 1: Encircle the right answer, cutting and overwriting is not allowed.   **(1x10=10)**

(i) The phenomenon of quark confinement is related to the fact that

    (a) α_s becomes very large at large distances

    (b) α_s becomes very large at short distances

    (c) α_s becomes very small at large distances

    (d) α_s becomes very small at short distances

(ii) In β^+ decay an up quark converts into

    (a) strange quark   (b) anti down

    (c) anti up   (d) down quark

(iii) The process $p \rightarrow \pi^+ + \pi^0$ is not allowed due to violation of conservation of ————

    (a) lepton no   (b) baryon no

    (c) electric charge   (d) meson no

(iv) Hadrons can exist if

    (a) total electric charge is zero   (b) total isospin is zero

    (c) total color charge is zero   (d) color spin is zero

(v) Isospin is symmetry of

    (a) weak interaction   (b) strong interaction

    (c) electromagnetic interaction   (d) all of these

(vi) The anti-top quark $(\bar{t})$ carries a charge of

    (a) +1/3   (b) +2/3

    (c) -1/3   (d) -2/3

(vii) Which of the following forces have infinite range?

    (a) Electromagnetic and Gravitational forces

    (b) Electromagnetic and Weak forces

    (c) Strong and Gravitational forces

    (d) Weak and Gravitational forces

(viii) Using Lorentz gauge, the Maxwell equations can be written in the following 4-vector form

    (a) $\Box^2 A^\mu = j^\mu$ (b) $\Box^2 A^\mu = \rho^\mu$

    (c) $\Box^2 A^\mu = 0$ (d) $\Box^2 A^\mu = -j^\mu$

(ix) The G-parity of charged and neutral pions is

    (a) +1   (b) -1

    (c) 0   (d) none of them

(x) For ground state all the baryons have

    (a) odd parity   (b) mixed parity

    (c) even parity   (d) conserved parity

UNIVERSITY OF THE PUNJAB

Seventh Semester – 2019
Examination: B.S. 4 Years Program

Roll No. ....

PAPER: Particle Physics-I
Course Code: PHY-407   Part – II

MAX. TIME: 2 Hrs. 45 Min.
MAX. MARKS: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED
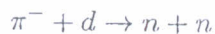
Question 2:
$(2 \times 10 = 20)$

Write short answers of the following questions.

(i) Draw the Feynman diagram showing the mechanism of β^--decay.

(ii) Define baryons and mesons. How are they different? Give their examples.

(iii) Give the relative strengths and the mediating particles of the strong, weak and electromagnetic interactions.

(iv) Define parity operation. What are the eigenvalues of the corresponding operator?

(v) What are the values of the spin, isospin, charge and strangeness quantum numbers of the charm quark?

(vi) State CPT theorem.

(vii) Give an example of Strange particles. Explain why are they called Strange particles.?

(viii) Which interaction is responsible for the decay $K^0 \to \pi^+ \pi^-$ and why?

(ix) How many and which quarks does Σ^+ contain?

(x) Briefly explain the phenomena of asymptotic freedom and quark confinement.

Question 3:
(10)

What is parity? Determine the intrinsic parity of pion (π^-) by considering the reaction:

$$\pi^- + d \to n + n$$

Question 4:
(10)

Show that four Maxwell equations are equivalent to the following field equation in Lorentz gauge.

$$\Box^2 A^\mu = J^\mu$$

Question 5:
(10)

What is charge conjugation operation and what are the eigen values of the corresponding operator? Show that a proton-antiproton system in a state of definite orbital angular momentum, l, and spin, s, is an eigen state of the charge conjugation operator with eigen value $(-1)^{l+s}$.