

(i) Printed Pages : 3

Roll No. ....

(ii) Questions : 9

Sub. Code : 

2	6	1	1	5
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Exam. Code : 

0	4	7	5
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M.Sc. Physics 4<sup>th</sup> Semester  
(2055)

PARTICLE PHYSICS -II

Paper : PHY-8042

Time Allowed : Three Hours]

[Maximum Marks : 80

**Note** :— Attempt **five** questions in all, selecting **one** question each from Units I-IV and the compulsory question from Unit-V.

### UNIT—I

1. (a) Construct the irreducible representations of baryons in SU(6) using Young's tableaux method.  
(b) Within SU(3) multiplets, how do you explain large mass splitting in hadrons ?  
(c) What do you mean by quark confinement, asymptotic freedom, renormalization and gauge invariance ? 8,4,4
2. (a) Write a note on orthogonal group.  
(b) Discuss the applications and limitations of SU(3) group.  
(c) Define a symmetry group. Demonstrate through an example that the symmetry group obeys properties of closure, identity, inverse and associativity. 6,5,5

## UNIT—II

3. (a) On the basis of quark model, show that ratio of magnetic moment of proton and neutron is  $-3/2$ .  
(b) Write a note on constituent quark model. 8,8
4. (a) Explain the terms global and local gauge invariance. Write down the Klein Gordon Lagrangian and show that it has global gauge invariance. Work out the steps to make this Lagrangian local gauge invariant.  
(b) Making use of argument based upon magnetic moment, show that proton and neutron do not have point like structure. 12,4

## UNIT—III

5. (a) What are Fermi and Gamow-Teller transitions ? Explain with example. Discuss four fermion Fermi theory of weak interactions.  
(b) Write a note on  $c\bar{c}$  and  $b\bar{b}$  systems. 10,6
6. (a) Elaborate Abelian gauge theory.  
(b) Describe the features of QCD and write its Lagrangian. 8,8

## UNIT—IV

7. (a) What is spontaneous symmetry breaking ? Elaborate with example.  
(b) What is Higgs boson ? How was it discovered ? 12,4

8. (a) How does Glashow-Weinberg-Salam model unify electromagnetic and weak interactions ?  
(b) What is standard model of particle physics ? What fundamental forces and particles does it describe ? Why is the standard model considered one of the most successful theories in physics ?

10,6

### UNIT—V

9. (a) What is the need of non-abelian gauge theories ?  
(b) What are neutrinos ? What is mass, charge and helicity of neutrino ?  
(c) Why the hadrons are colorless ?  
(d) What are neutral and charged current reactions ? Explain with example.  
(e) What do you mean by helicity ?  
(f) How did Maxwell's equations contribute to the idea of unification ?

3,3,3,3,2,2