MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No. | | | | | | | | | | |

DEPARTMENT OF SCIENCES, M. Sc. (Physics)
IV SEMESTER, END SEMESTER EXAMINATIONS
JUNE 2021
Subject: QUANTUM FIELD THEORY (PHY-5014)
(REVISED CREDIT SYSTEM - 2017)

Time: 2 Hours **Date: June 2021** **MAX. MARKS: 40**

Note: (i) Answer any four questions.
(ii) Answer the questions to the point. Show all the calculation steps.

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1. (i) Discuss the relativistic form of uncertainty relations. [5]
(ii) Find the conserved quantities of space - time translation symmetry with the Noether theorem. [5]

2. (i) Write the expression of Lagrangian density of a complex scalar field. Obtain the equation of motions from this. Obtain the expression of Hamiltonian density. [5]
(ii) What do you mean by normal ordering? Why is this important? [5]

3. (i) Construct the electromagnetic field strength tensor. Express the Maxwell equations in terms of these tensors. [5]
(ii) What are Lorentz gauge, temporal gauge, and Coulomb gauge? [5]

4. (i) Obtain a relation between decay rate and transition matrix element. [5]
(ii) Discuss about phase space factor in decay constant. [5]

5. (i) What is S-matrix? Why is this useful? [5]
(ii) Illustrate Wick's theorem for the case of four operators. [5]

6. (i) What is infra-red divergence? [2]
(ii) What do you mean by renormalization? [2]
(iii) How do we determine superficial degree of divergence(D)? What happen if D is positive, zero, and negative? [6]
