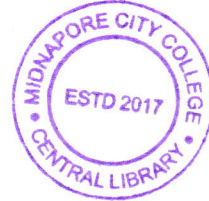


PG (CBCS)
M.SC. Semester- IV Examination, 2026
PHYSICS
 PAPER: PHS 401
(QUANTUM FIELD THEORY)

**Full Marks: 20****Time: 1 Hours**

The figures in the right-hand margin indicate full marks.
 Candidates are required to give their answers in their own words as far as practicable.

GROUP-AAnswer any **TWO** of the following questions:

2×2=4

1. In Dirac field Lagrangian density $\mathcal{L} = \bar{\Psi}(i\gamma^\mu \partial_\mu - m)\Psi$;
Deduce current density $j^\mu = \bar{\Psi}\gamma^\mu\Psi$
2. Discuss Higg's mechanism.
3. Define scalar product of two K.G. wave functions ϕ and χ .
4. Prove that the time reversal operator is anti unitary.

GROUP-BAnswer any **TWO** of the following questions:

2×4=8

5. Prove that $(P-m)\bar{\Psi} = 0$ (use Dirac lagrangian density).
6. What is Weinberg – Salem model of weak and electromagnetic interactions?
7. State and prove Wick's theorem.
8. Show that $\langle 0|T[\phi(x)\phi(\acute{x})]|0\rangle = \overline{\phi(x)}\phi(\acute{x})$

GROUP-CAnswer any **ONE** of the following questions:

1×8=8

9. If in real scalar field $\hat{H} = \frac{1}{2} \int d^3x (\Pi^2(x) + (\nabla\hat{\phi})^2 + m^2\hat{\phi}^2)$.
Express in terms of creation and anhelation operators.
10. $e^-\mu^- \rightarrow e^-\mu^-$
Draw the Feynman diagram and calculate scattering amplitude and interpret each term.

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