Unit 12 - Week 10

Assessment 10

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-11-25, 23:59 IST.

1) If two events x & y are spacelike separated, then the value of the commutator $\left[\varphi(x),\varphi(y)\right]$, where $\varphi(x)$ and $\varphi(x)$ are respectively the field variables at x & y, is: *1 point*

- $i\hbar$
- ∞
- Non-zero real number
- 0

No, the answer is incorrect.
Score: 0
Accepted Answers:
0

2) If two events x & y are spacelike separated, then the asymptotic behavior of the Feynman propagator for large spatial separation r between x & y is: *1 point*

- Resembles $\exp(imr)$
- Resembles $\exp(-mr)$
- Resembles $\exp(-imr)$
- Resembles $\ln(-imr)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
Resembles $\exp(-mr)$

3) Which of the following is not true: *1 point*

- For spacelike separation, the amplitude for particle propagation is zero.
- For timelike separation, the amplitude for particle propagation is non-zero.
- In the case of Feynman propagator, in doing the contour integration for the k^0 i.e. ω integration, the singularities on the real axis are pushed infinitesimally into the second and fourth quadrant.
- From the point of view of the measurements of particles at spacetime locations x and y, the Klein Gordon field does preserve causality.

No, the answer is incorrect.
Score: 0
Accepted Answers:
For spacelike separation, the amplitude for particle propagation is zero.

4) The representation of the field variable $\varphi(x)$ in terms of the creation and annihilation operators in Minkowski space with the flat metric $diag(+1,-1,-1,-1)$ takes the form: *1 point*

- $\varphi(x)=\frac{1}{(2\pi)^3}\int\frac{d^3k}{2\omega_{\vec{k}}}\left(a_{\vec{k}}e^{-ikx}-a_{\vec{k}}^{\dagger}e^{-ikx}\right)$
- $\varphi(x)=\frac{1}{(2\pi)^3}\int d^3k\left(a_{\vec{k}}e^{ikx}+a_{\vec{k}}^{\dagger}e^{ikx}\right)$
- $\varphi(x)=\frac{1}{(2\pi)^3}\int d^3k\left(a_{\vec{k}}e^{kx}+a_{\vec{k}}^{\dagger}e^{kx}\right)$
- $\varphi(x)=\frac{1}{(2\pi)^3}\int\frac{d^3k}{2\omega_{\vec{k}}}\left(a_{\vec{k}}e^{-ikx}+a_{\vec{k}}^{\dagger}e^{ikx}\right)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\varphi(x)=\frac{1}{(2\pi)^3}\int\frac{d^3k}{2\omega_{\vec{k}}}\left(a_{\vec{k}}e^{-ikx}+a_{\vec{k}}^{\dagger}e^{ikx}\right)$

5) The derivative of the unit step function $\theta(t)$ is equal to: *1 point*

- 0
- 1
- $\delta(t)$
- $-1/\delta(t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\delta(t)$

6) Which of the following is not true in context of effective action $\Gamma(\phi)$: *1 point*

- $\frac{\delta^2 W[J]}{\delta J(x)\delta J(y)}=\left(\frac{\delta^2\Gamma[\Phi]}{\delta\Phi(x)\delta\Phi(y)}\right)^{-1}$
- The effective action is the Legendre transform of the generating functional for connected graphs W[J]
- The effective action is the action whose tree level solution (diagrams) represent the full quantum solution of the original quantum action
- The effective action generates the full Green's functions of the theory

No, the answer is incorrect.
Score: 0
Accepted Answers:
The effective action generates the full Green's functions of the theory

7) The effective action $\Gamma[\Phi]$ for the φ^4 Klein Gordon fieldcan be written in the form: *1 point*

- $\frac{\partial W(J)}{\partial J}+\frac{\partial}{\partial J}$
- $\Phi(J)+\frac{\partial W(J)}{\partial J}$
- $-W[J]+\int dx\Phi(x)J(x)$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-W[J]+\int dx\Phi(x)J(x)$

8) The derivative of the effective action with respect to the field function gives us: *1 point*

- The generating functional for the connected Green's functions $W(J)$
- The current $J(x)$
- The 2-point full Green's function
- The generator for the 1PI Green's functions

No, the answer is incorrect.
Score: 0
Accepted Answers:
The current $J(x)$

9) Consider the Lagrangian $\mathcal{L}=\mathcal{L}_0+\mathcal{L}_{int}$ where $\mathcal{L}_0=\frac{1}{2}\partial^{\mu}\varphi\partial_{\mu}\varphi-\frac{1}{2}m^2\varphi^2$ and $\mathcal{L}_{int}=-\lambda V(\varphi)$ of an interacting Klein Gordon field in Minkowski space with the flat metric $diag(+1,-1,-1,-1)$. The expression for the generating functional for the full Green's functions can be written as $Z[J]=\mathcal{N}\exp\left[-i\int d^4x\lambda V\left(\frac{1}{i}\frac{\delta}{\delta J(x)}\right)\right]Z_0$ where Z_0 is: *1 point*

- $\int[D\varphi]\exp\left[i\int d^4x\left(\mathcal{L}_0+J\varphi\right)\right]$
- $\int[D\varphi]\exp\left[\int d^4x\mathcal{L}_0\right]$
- $\int dx\exp\left[i\int d^4x\mathcal{L}_0\right]$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\int[D\varphi]\exp\left[i\int d^4x\left(\mathcal{L}_0+J\varphi\right)\right]$

10) Let $\Delta(x-x')$ represent the Feynman propagator for the free Klein Gordon equation in Minkowski space. Then, $\left(\Box+m^2\right)\int d^4x'\Delta(x-x')J(x')$ equals *1 point*

- $\delta(x-x')$
- $\Delta(x)$
- $J(x)$
- $\frac{\hbar}{m^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$J(x)$