PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Integral Equations - CSIR NET Physics PYQs

Mathematical Physics . All PYQs (2015-2025) with answer key

3 questions . Answer key included

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Q1. [June 2016] . 5.0 marks

Mathematical Physics > Integral Equations

CSIR NET	2016 June	5M

The integral equation

$$\phi(x,t) = \lambda \int dx' dt'$$

$$\int \frac{d\omega dk}{(2\pi)^2} \frac{e^{-ik(x-x')+i\omega(t-t')}}{\omega^2 - k^2 - m^2 + i\epsilon} \phi^3(x',t')$$

is equivalent to the differential equation

1. $\left(\frac{\partial^2}{\partial t^2} + \frac{\partial^2}{\partial x^2} - m^2 + i\epsilon\right)\phi(x,t) = -\frac{1}{6}\lambda\phi^3(x,t)$

2. $\left(\frac{\partial^2}{\partial t^2} - \frac{\partial^2}{\partial x^2} + m^2 - i\epsilon\right)\phi(x,t) = \lambda\phi^2(x,t)$

3. $\left(\frac{\partial^2}{\partial t^2} - \frac{\partial^2}{\partial x^2} + m^2 - i\epsilon\right)\phi(x,t) = -3\lambda\phi^2(x,t)$

4. $\left(\frac{\partial^2}{\partial t^2} - \frac{\partial^2}{\partial x^2} + m^2 - i\epsilon\right)\phi(x,t) = -\lambda\phi^3(x,t)$

Q2. [Dec 2017] . 5.0 marks
Mathematical Physics > Integral Equations

CSIR NET	2017 Dec	5M

The generating function $G(t,x)$ for the Legendre polynomials $P_n(t)$ is

$$G(t,x) = \frac{1}{\sqrt{1-2xt+x^2}} = \sum_{n=0}^{\infty} x^n P_n(t), \text{ for } |x| < 1$$

If the function $f(x)$ is defined by the integral equation $\int_0^x f(x')dx' = xG(1,x)$, it can be expressed as

1. $\sum_{n,m=0}^{\infty} x^{n+m} P_n(1) P_m\left(\frac{1}{2}\right)$
2. $\sum_{n,m=0}^{\infty} x^{n+m} P_n(1) P_m(1)$
3. $\sum_{n,m=0}^{\infty} x^{n-m} P_n(1) P_m(1)$
4. $\sum_{n,m=0}^{\infty} x^{n-m} P_n(0) P_m(1)$

Q3. [June 2024] . 5.0 marks

Mathematical Physics > Integral Equations

CSIR NET	2024 June	5M

An integral transform $\tilde{f}(x)$ of a function $f(x)$ can be regarded as a result of applying an operator F to the function such that

$$(Ff)(x) \equiv \tilde{f}(x) = \int_{-\infty}^{\infty} dy e^{-ixy} f(y)$$

If I is the identity operator, then the operator F^4 is given by

1. $(2\pi)^4 I$
2. $(2\pi) I$
3. I
4. $(2\pi)^2 I$

Answer Key

3 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Mathematical Physics	Integral Equations	**4**
Q2	Mathematical Physics	Integral Equations	**2**
Q3	Mathematical Physics	Integral Equations	**4**

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