

17P109

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Name:

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2017

(Regular/Supplementary/Improvement)

(CUCSS-PG)

CC15P PHY1 C02/ CC17P PHY1 C02 – MATHEMATICAL PHYSICS - I

(Physics)

(2015 Admission onwards)

Time: Three Hours

Maximum: 36 Weightage

PART - A

Answer *all* questions. Each question carries 1 weightage.

1. Write down the rotation matrix for the rotation of co-ordinates through an angle θ about the z axis.
2. Give the expression for volume element in cylindrical co-ordinates. What are the scale factors?
3. What do you mean by contraction of tensors? Illustrate with an example.
4. Define Hermitian matrices and Unitary matrices. Give example to each case.
5. Define Levi-Civita three index symbol.
6. Explain self-adjoint differential equations.
7. Prove that the Legendre polynomial $P_n(1)=1$.
8. Explain Fuch's theorem.
9. What are the properties of Hermitian operators?
10. Define β function and show that $\beta(1/2, 1/2)=\pi$.
11. State the first shifting theorem of Laplace transform.
12. State Fourier series formula for a periodic function of period $2L$ in the interval $(-L, L)$.

(12 × 1 = 12 weightage)

PART -B

Answer any *two* questions. Each question carries 6 weightage.

13. Derive the expression for gradient, divergence and curl in general curvilinear co-ordinate system. Use the result to find the expressions for the same in circular cylindrical and spherical polar co-ordinates.
14. Obtain the series solution of Bessel's equation. Explain the limitations of this solution.
15. Derive and explain Fourier integral theorem. Use this to define Fourier transform and inverse Fourier transform.
16. Explain Gram-Schmidt orthogonalisation procedure with suitable example.

(2 × 6 = 12 weightage)

PART -C

Answer any **four** questions. Each question carries 3 weightage.

17. Prove that Cylindrical coordinate system is orthogonal.
18. Show that $P_n(x)$ is the coefficient of t^n in the expansion of $(1-2xt+t^2)^{-1/2}$.
19. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$
20. Derive the recurrence relation $\Gamma(z+1) = z\Gamma z$.
21. Find the Fourier series of the function: $f(x) = x^2, -\pi \leq x \leq \pi$.
22. Using partial fraction expansion, find inverse Laplace transform of $\frac{1}{(s^2+4)(s^2+9)}$.
(4 × 3 = 12 weightage)

2. Give the expression for volume element in cylindrical co-ordinates. What are the scale factors?
3. What do you mean by contraction of tensors? Illustrate with an example.
4. Define Hermitian matrices and Unitary matrices. Give example to each case.
5. Define Levi-Civita three index symbol.
6. Explain self-adjoint differential equations.
7. Prove that the Legendre polynomial $P_n(1) = 1$.
8. Explain Fuchs's theorem.
9. What are the properties of Hermitian operators?
10. Define β function and show that $\beta(\sqrt{2}, \sqrt{2}) = \pi$.
11. State the first shifting theorem of Laplace transform.
12. State Fourier series formula for a periodic function of period $2L$ in the interval $(-L, L)$.
(12 × 1 = 12 weightage)

PART -B

Answer any two questions. Each question carries 6 weightage.

13. Derive the expression for gradient, divergence and curl in general curvilinear co-ordinate system. Use the result to find the expressions for the same in circular, cylindrical and spherical polar co-ordinates.
14. Obtain the series solution of Bessel's equation. Explain the limitations of this solution.
15. Derive and explain Fourier integral theorem. Use this to define Fourier transform and inverse Fourier transform.
16. Explain Gram-Schmidt orthogonalisation procedure with suitable example.
(2 × 6 = 12 weightage)