

Unit III

No. of Printed Pages : 06

Roll No.

5. (a) Evaluate the integral using Cauchy integral theorem $\oint_C \frac{dz}{z}$, where C is a

simple closed curve. **10**

- (b) Define an analytic function in a complex Domain D. State and prove necessary and sufficient conditions for a function to be analytic. **10**

6. (a) Using the method of contour integration evaluate : **8**

$$I = \int_0^{2\pi} \frac{d\theta}{(5 + 4\cos\theta)}$$

- (b) Use calculus of residue to evaluate : **8**

$$\int_{-\infty}^{\infty} \frac{dx}{(x^2 + 9)}$$

AA-281

M. Sc. EXAMINATION, May 2017

(First Semester)

(Re-appear Only)

PHY-501-B

PHYSICS

Mathematical Physics

Time : 3 Hours]

[Maximum Marks : 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Determine the eigen values and corresponding eigen vectors of matrix : **10**

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$

- (b) Explain and prove Quotient law of tensors. Under what conditions it is inapplicable. **10**
2. (a) For a Hermitian matrix, prove that its eigen values are real and its eigen vectors are orthogonal. **10**
- (b) If a contravariant tensor of rank two is skew-symmetric in one coordinate system, show that it is skewsymmetric in any coordinate system. **5**

M-AA-281

2

- (c) Explain the following : **5**
- (i) Metric Tensors
- (ii) Contraction theorem for tensors.

Unit II

3. (a) Solve the following differential equation using Frobenius method : **15**

$$\left(x^2 - x\right) \frac{d^2 y}{dx^2} - (1 + 3x) \frac{dy}{dx} - y = 0$$

- (b) Prove that : **5**
- $$P_n(1) = 1, P_n(-x) = (-1)^n P_n(x),$$
- $$P_n(-1) = (-1)^n \text{ and }$$
- $$P_{2n+1}(0) = 0.$$

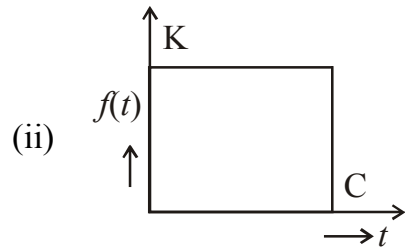
4. (a) Establish Rodrigue formula for Legendre polynomials. **10**
- (b) Obtain an expression for Hermite polynomial of order n using generating function approach. **6**
- (c) Prove that : **4**

$$J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cdot \sin x.$$

(3-05/7) M-AA-281

3

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(iii) $f(t) = t^2 \sin^3 6t$.

(b) Find Fourier transform of δ function. **4**

(c) Find Fourier sine transform of function $e^{-|t|}$ and hence evaluate : **6**

$$\int_0^{\infty} \frac{t \cdot \sin mt}{(t^2 + 1)} dt.$$

(c) Prove that the function given by $u = x^2 - y^2 - 2xy - 2x + 3y + 6$ is harmonic. **4**

Unit IV

7. (a) Find inverse Laplace transform of the following function by convolution theorem : **10**

$$F(s) = \frac{s}{(s^2 + a^2)(s + b)}$$

(b) Find the even series expansion of $f(x) = r - x$ in the interval $0 < x < \pi$. **10**

8. (a) Find Laplace Transform of the following function : **10**

