



**K19P 0113**

Reg. No. : .....

Name : .....

**IV Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, April 2019  
(2014 Admission Onwards)**

**PHYSICS**

**PHY-4C15 : Numerical Techniques and Probability**

Time : 3 Hours

Max. Marks : 60

**SECTION – A**

Answer **both** questions, either **a)** or **b)**. Each question carries **12** marks.

1. a) i) What do you mean by random experiment and random variables. What are the different classifications of random variables ? Explain with examples.  
ii) What do you mean by expected value of a random variable ? Define mean and variance in terms of expectation.

**OR**

- b) What do you mean by normal distribution ? What are its constants ? Explain different properties of normal distribution. What are the area properties of normal distribution ?

2. a) i) Discuss the convergence of Newton-Raphson method.  
ii) What do you mean by interpolation ? Derive Newton's backward interpolation formula for equal intervals.

**OR**

- b) i) Explain Simpson's  $\frac{1}{3}$  rule for numerical integration.  
ii) Explain least square method for fitting a second degree parabola  
 $y = ax^2 + bx + c.$  **(2×12=24)**

**SECTION – B**

Answer **any four** (1 mark for Part 'a', 3 marks for part 'b', 5 marks for part 'c') :

3. a) State addition theorem of probability.  
b) State and prove multiplication theorem of probability.

**P.T.O.**



- c) A factory has 3 production lines I, II and III contributing 20%, 30% and 50% respectively, to its total output. The percentage of substandard items produced by lines I, II and III are respectively 15, 10 and 2. If an item chosen at random from the total output is found to be substandard, what is the probability that the item is from line I ?
4. a) What is the standard deviation of a Poisson distribution with parameter  $\lambda$  ?  
 b) Explain the probability density function of Chi-square distribution.  
 c) Fit a binomial distribution to the following data :
- |            |    |    |    |    |    |    |   |
|------------|----|----|----|----|----|----|---|
| <b>x</b> : | 0  | 1  | 2  | 3  | 4  | 5  | 6 |
| <b>f</b> : | 13 | 25 | 52 | 58 | 32 | 16 | 4 |
5. a) Write Regula-Falsi method formula :  
 b) Find the function whose first difference is  $x^3 + 3x^2 + 5x + 12$ .  
 c) Use the method of iteration to find the real root lying between 1 and 2 of the equation  $x^3 - 3x + 1 = 0$ .
6. a) Define backward difference operator.  
 b) Draw forward difference table for the following data :
- |            |     |     |     |     |     |     |     |
|------------|-----|-----|-----|-----|-----|-----|-----|
| <b>x</b> : | 0   | 1   | 2   | 3   | 4   | 5   | 6   |
| <b>y</b> : | 176 | 185 | 194 | 203 | 212 | 220 | 229 |
- c) Use Lagrange's formula to find the value of  $y$  at  $x = 6$  from the following data  $y(3) = 168$ ,  $y(7) = 120$ ,  $y(9) = 72$ ,  $y(10) = 63$ .
7. a) Write trapezoidal rule formula for numerical integration.  
 b) Explain two point Gaussian quadrature formula for the numerical integration of  $\int_a^b f(x)dx$ .  
 c) Using Simpson's  $1/3^{\text{rd}}$  rule evaluate  $\int_0^{10} \frac{dx}{1+x^2}$  by taking  $h = 1$ .
8. a) Write Runge-Kutta second order formula for solving first order ordinary differential equation.  
 b) Explain Euler's method to solve first order ordinary differential equations.  
 Using Euler's method find the value of  $y$  at  $x = 0.1$  given  $\frac{dy}{dx} = 1 - y$ ,  $y(0) = 0$ .  
 c) Compute  $y(0.1)$  by Runge-Kutta method of 4<sup>th</sup> order for the differential equation  $\frac{dy}{dx} = xy + y^2$ ,  $y(0) = 1$ . **(4×9=36)**
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