K20P 0122

IV Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.) Examination, April 2020
(2014 Admission Onwards)
PHYSICS
PHY4C15 : 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) Define Binomial distribution and Poisson distribution. Derive Poisson distribution as a limiting case of binomial distribution.

    OR

   b) What do you mean by Chi-square distribution ? What is its pdf ? How it can be used for the goodness of fit ?

2. a) What do you mean by interpolation ? Derive Newton's forward interpolation formula for equal intervals.

    OR

   b) Derive formula for Trapezoidal rule for numerical integration of $\int_a^b f(x)\, dx$. Also explain the geometrical interpretation of Trapezoidal rule.   **(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) Define probability.

   b) Two similar urns A and B contain 2 white and 3 red balls, 4 white and 5 red balls respectively. If a ball is selected at random from one of the urns, find the probability that the urn is B, when the ball is red.

   c) State and prove addition theorem on probability.

P.T.O.

4. a) What do you mean by standard normal distribution ?

 b) The marks of 1000 students in a university are found to be normally distributed with mean 70 and standard deviation 5. Estimate the number of students whose marks will be (i) between 60 and 75 (ii) more than 75 and (iii) less than 68.

 c) Fit a binomial distribution to the following data :

x	0	1	2	3	4	5
f	3	6	24	26	4	1

5. a) What is the order of convergence of Newton-Raphson method ?

 b) Explain bisection method to find a root of the equation $f(x) = 0$.

 c) Using Regula-Falsi method, find a real root lying between 1 and 2 of the equation $x^3 - 3x + 1 = 0$ upto 3 places of decimals.

6. a) State Lagrange's interpolation formula.

 b) Find the nth difference of e^x.

 c) Find the second difference of the polynomial $f(x) = x^4 - 12x^3 + 42x^2 - 30x + 9$ with $h = 2$.

7. a) What is the order of error in Simpson's one third rule ?

 b) The velocity v of a particle at distance s from a point on its path is given by the table below :

 s in meter   0 10 20 30 40 50 60

 v metre per sec 47 58 64 65 61 52 38

 Evaluate the time taken to travel 60 metres by Simpson's three eighth rule.

 c) Evaluate $\int_{-1}^{1} e^{-x^2} \cos x \, dx$ by Gauss two and three point quadrature formula.

8. a) Write Euler's formula to find the value of $y(x_1)$ from the differential equation $\dfrac{dy}{dx} = f(x, y)$, $y(x_0) = y_0$.

 b) Using Euler's modified method, find the value of y at $x = 0.1$, given that $\dfrac{dy}{dx} = 1 - y$, $y(0) = 0$.

 c) Compute $y(0.1)$ by Runge-Kutta method of 4th order for the differential equation $\dfrac{dy}{dx} = xy + y^2$, $y(0) = 1$. (4×9=36)

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