

BCA Semester-IV (Hons.) Examination, 2022-23**BACHELOR OF COMPUTER APPLICATION**

Course ID : 43314

Course Code : GE-04

Course Title : Mathematics-III

Time : 3 Hours

Full Marks : 80

*The figures in the right-hand margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Illustrate the answers wherever necessary.***GROUP-A**

1. Choose the best alternative from the following options for each questions: $1 \times 10 = 10$

a) For any two events A and B it is given that $P(A^c) = 0.4$, $P(AB) = 0.3$ and $P(A/B) = 0.75$. The value of $P(B^c)$ is

- i) 0.9 ii) 0.6
 iii) 1.5 iv) 0.54

b) ${}^{n+1}C_r =$

- i) ${}^nC_r + {}^nC_{r-1}$ ii) ${}^nC_{r+1} + {}^nC_{r-1}$
 iii) ${}^{n-1}C_r + {}^nC_{r-1}$ iv) ${}^nC_r + {}^nC_{r-2}$

- c) Mean Deviation is minimum when taken about
 i) Mean ii) Harmonic Mean
 iii) Median iv) Mode
- d) In sampling theory, SRSWR means
 i) Simple Random Sampling with Reasoning
 ii) Stratified Random Sampling with Replacement
 iii) Simple Replacement Sampling with Reasoning
 iv) Simple Random Sampling with Replacement.
- e) Significance level of a test is associated with
 i) Power of the test
 ii) Type II error
 iii) Type I error
 iv) None of these
- f) An unbiased die is thrown. Then the mathematical expectation of the number on the face appeared is
 i) $1/2$ ii) $7/2$
 iii) $13/2$ iv) $3/2$

- g) Which one of the following is correct?
- Bisection method is an iterative method
 - Regula Falsi method is direct method
 - Secant method is direct method
 - Newton Raphson method is not iterative method
- h) Gauss Seidel iterative method can be used for solving a set of
- Linear differential equation only
 - Linear algebraic equations only
 - Both linear and nonlinear algebraic equations
 - Both linear and nonlinear differential equations
- i) In Simpson's 1/3 rule, the actual area under the curve is replaced by
- A parabola
 - a straight line
 - any curve
 - a trapezium
- j) Lagrange's interpolation formula can be used for
- Equi-spaced argument values only
 - Equi-spaced and non-equispaced argument values
 - Non-equispaced argument values only
 - None of the above.

GROUP-B

2. Answer any **ten** of the following questions:

$$2 \times 10 = 20$$

- Prove that $E\{|g(X)|\} \leq E\{|g(X)|^2\}$ where $g(X)$ is any function of continuous random variable X .
- The coefficient of variation is 40 and the arithmetic mean is 30; find the standard deviation.
- What do you mean by Scatter diagram?
- What is the difference between linear regression and multiple regression?
- A simple random sample of size 5 is drawn without replacement from a finite population consisting of 41 units. If the population standard deviation is 6.25, what is the standard error of sample mean? (Use finite population correction).
- Write down any two properties of Student's t distribution.
- Prove that $\Delta(x + \cos x) = h - 2 \sin\left(x + \frac{h}{2}\right) \sin \frac{h}{2}$. (h is the step length).
- Why does one need to use numerical method instead of analytical method for integration?

- i) Examine whether the Gauss Seidel iteration method is applicable or not for the following system of equation:

$$x + 5y + z = 1$$

$$4x + 3y + 2z = -3$$

$$x + 2y - 3z = 2$$

- j) What are the drawbacks of Taylor's series method for first order ODE?
- k) Write down the condition of convergence of N-R method. Mention that whether the condition is sufficient or necessary or both.
- l) If the letters of the word 'MOTHER' are arranged at random, find the probability that the vowels will be next to each other.
- m) What is the difference between Type I and Type II errors in the Hypothesis theory?
- n) What do you mean by Statistical Inference?
- o) 100 liters of water are supposed to be polluted with 10^5 bacteria. Find the probability that a sample of 1 c.c. of the same water is free from bacteria.

GROUP-C

3. Answer any **four** of the following questions:

5×4=20

- a) Define probability distribution function and prove that the distribution function is leftly discontinuous.
- b) Find the arithmetic mean and standard deviation of the first n natural numbers.
- c) Write down the p.d.f. of normal distribution and find $P(|X - 50| \leq 20)$ where X is a random variable following normal $N(50, 20)$ distribution.

$$\left[\text{Given } \frac{1}{\sqrt{2\pi}} \int_{-\infty}^1 e^{-\frac{x^2}{2}} dx = 0.8413 \right].$$

- d) i) Define correlation and covariance.
ii) For random variables X and Y with the same mean, the two regression equations are $Y = aX + b$ and $X = \alpha Y + \beta$. Show that

$$\frac{b}{\beta} = \frac{1-a}{1-\alpha}.$$

- e) Derive the Newton's forward interpolation formula.
- f) Explain Euler's method for solving first order ODE with its advantages and drawbacks.

GROUP-D

4. Answer any **three** of the following questions:

$$10 \times 3 = 30$$

- a) i) Given $r_{12} = -0.7$, $r_{13} = 0.6$, and $r_{23} = 0.52$, compute the correlation between X_1 and X_2 while controlling for X_3 . $N = 40$ for all r .
- ii) For a symmetrical distribution A.M = Median = 8.5. The semi-interquartile range is 4. Find the first and third quartile.
- iii) If θ be the acute angle between the two regression lines, then show that

$$\tan \theta = \frac{1-r^2}{r} \frac{S_x S_y}{S_x^2 + S_y^2}$$

where r is the correlation coefficient and S_x and S_y are the respective S.D. 3+3+4

- b) i) Prove that $f(x) = \frac{1}{2} e^{-|x|}$, $-\infty < x < \infty$ is a possible probability density function. Find the corresponding distribution function.
- ii) Nine patients to whom a certain drug was administered, registered the following rise of blood pressure: 3, 7, 4, -1, -3, 6, -4, 1, 5. Test the hypothesis that the drug does not rise blood pressure at 10% level of

significance. (Assume that the sample from a normal population)

[$P(t > 1.86) = 0.05$ for 8 degrees of freedom.]

- c) i) Deduce the condition of convergency of Fixed-point iteration method.
- ii) Evaluate $\int_{-1}^3 |x| dx$ numerically by Trapezoidal rule taking four equal subintervals.
- iii) The following values of the function $f(x)$ for value of x are given: $f(1) = 4$, $f(2) = 5$, $f(7) = 5$, $f(8) = 4$. Find the values of $f(6)$ and also the value of x for which $f(x)$ is maximum or minimum. 3+3+4
- d) i) Describe Regula Falsi method.
- ii) Find the error term in Simpson's 1/3 integration formula.
- e) i) Find the mean and variance of normal $N(m, \sigma)$ distribution.
- ii) For a normal $N(m, \sigma)$ population, find the sampling distribution of s^2 , where $(n-1)s^2 = nS^2$, S^2 being the sample variance.