2021

MATHEMATICS (Honours)

Paper Code : VI - A & B

(New Syllabus)

Important Instructions for Multiple Choice Question (MCQ)

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

  Example : Such as for Paper III-A (MCQ) and III-B (Descriptive).

  Subject Code : | III | A | & | B |

  Subject Name : [ ]

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

  Example — If alternative A of 1 is correct, then write :
  1. — A

- There is no negative marking for wrong answer.

মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

- উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

Subject Code : | III | A | & | B |

Subject Name : [ ]

- পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A) / (B) / (C) / (D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

উদাহরণ — যদি **1** নম্বর প্রশ্নের সঠিক উত্তর **A** হয় তবে লিখতে হবে :

1. — A

- ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

Paper Code : VI - A

Full Marks : 20   Time : Thirty Minutes

Choose the correct answer.

Each question carries 2 marks.

Notations and symbols have their usual meanings.

1. The missing term $f(3)$ from $f(1) = 0$, $f(2) = 2$, $f(4) = 12$ and $f(5) = 20$ is

   A. 12

   B. 3

   C. 4

   D. 6

2. $(\frac{\Delta^2}{E})x^3 =$

   A. $6x$

   B. $16x$

   C. x

   D. $2x$

3. The interpolating polynomial of highest degree which corresponds the functional values $f(-1) = 9$, $f(0) = 5$, $f(2) = 3$ and $f(5) = 15$ is

   A. $x^3 + x^2 + 2x + 5$

   B. $x^2 - 3x + 5$

   C. $x^2 + 3$

   D. $x + 10$

4. The third order divided difference of the function $f(x) = \frac{1}{x}$ with arguments a, b, c and d is

A. $1/abcd$

B. $-1/abcd$

C. $1/abc$

D. $-1/abc$

5. For two events A and B, let $P(A) = 1/3$, $P(B) = 1/4$ and $P(A+B) = 1/2$, then $P(A \mid B)$ is

A. 1/3

B. 1/2

C. 1/4

D. 1

6. If the regression equation of Y on X is $Y = 0.57X + 6.93$ and the regression equation of X on Y is $X = 1.12Y - 2.46$, then the correlation coefficient between X and Y is

A. 1

B. 0.30

C. 0.80

D. 2

7. Two random variables X and Y have zero means and standard deviations 1 and 2 respectively. If X and Y are uncorrelated, then $\text{Var}(X+Y)$ is

A. 3

B. 5

C. 0

D. 2

8. Two independent events E and F are such that $P(E \cap F) = 1/6$, $P(E^c \cap F^c) = 1/3$ and $P(E) > P(F)$. Then $P(E)$ is

A. 1/2

B. 1/4

C. 1/3

D. 2/3

9. A box contains two coins, one of which is fair and the other two headed. One coin is chosen at random and tossed twice. If two heads appear, then the probability that the chosen coin was two headed is

A. 1/2

B. 1/4

C. 1/3

D. 4/5

10. The iterative method $x_{n+1} = g(x_n)$ for the solution of $x^2 - x - 2 = 0$ converges quadratically in a neighborhood of the root $x = 2$ if $g(x)$ equals

A. $x^2 - 1$

B. $(x - 2)^2 - 6$

C. $1 + 2/x$

D. $(x^2 + 2)/(2x - 1)$

2021

MATHEMATICS (Honours)

Paper Code : VI - B

(New Syllabus)

Full Marks : 80 Time : Three Hours Thirty Minutes

The figures in the margin indicate full marks.

Notations and symbols have their usual meanings.

Group-A
(40 Marks)

Answer question no. 1 and any *six* from the rest.

1. If $P(A \mid B) = 1$, then prove that $P(ABC) = P(BC)$. 4

or

A die is thrown 10 times in succession. Find the probability of obtaining six at least once. 4

2. The probability density function of a random variable X is given by $f(x) = Ce^{-(x^2+2x+3)}$, $-\infty < x < \infty$. Find the value of C, the expectation and the variance of the distribution. 2+2+2

3. Estimate the parameter α of a continuous population having the density function $(1+\alpha)x^\alpha$, $0 < x < 1$, by the method of maximum likelihood. 6

4. The random variables X and Y have the least square regression lines with equations $3x + 2y - 26 = 0$ and $6x + y - 31 = 0$. Find $E(X)$, $E(Y)$ and $\rho(X, Y)$. 2+2+2

5. For the continuous distribution defined by $f(x, y) = 3x^2 - 8xy + 6y^2$, $0 < x < 1$, $0 < y < 1$, find the regression curves for the means and also the least square regression lines. 6

6. If X possesses a finite second order moment about c, where c is any fixed number, then prove that for any $\varepsilon > 0$,

$$P(| X - c | \geq \varepsilon) \leq E[(X - c)^2]/\varepsilon^2. \qquad 6$$

7. If X_n is a sequence of random variables such that X_n converges to X in means square. Then show that $E(X_n) \to E(X)$ and $E(X_n^2) \to E(X^2)$ as $n \to \infty$. 6

8. An integer is chosen from first 100 positive integers. What is the probability that the integer is divisible by 6 or 8? 6

9. A two dimensional random variable (X, Y) has the spectrum $(x_i, y_j) = (i, j)$; $(i = 0, 1, 2, 3;\ j = 1, 2, 3, 4)$ and the joint probabilities p_{ij} is given by $p_{ij} = P(X = i; Y = j) = c(3i + 4j)$, where c is a constant. Find the value of c and the marginal distribution of X and Y. 2+4

10. Obtain the recurrence relation $\mu_{k+1} = \mu(k\mu_{k-1} + d\mu_k/d\mu)$ for the Poisson distribution with parameter μ. Hence find the coefficient of skewness and the coefficient of excess of the Poisson μ distribution. 4+1+1

Group-B
(40 Marks)

Answer question no. 11 and any *six* from the rest.

11. Find the approximate value of $\sqrt{11}$ by using Newton-Raphson method, correct upto four decimal places. 4

Or

Design an algorithm and draw a flowchart for finding the greatest common divisor of two non zero positive integers. 2+2

12. Show that the number of multiplications and divisions required in Gaussian Elimination Method for solving n independent equations with n unknowns is $n^3/3 + n^2 - n/3$. 6

13. Let $f(x)$ be an unknown function with given values $y_i = f(x_i)$, $i = 0, 1, 2, \ldots, n$. Find $f'''(x)$ and also $f'''(x_n)$ by using Newton's Backward interpolation formula. 4+2

14. Derive Simpson's $\frac{1}{3}$ rule with error terms. 6

15. Find a root of the equation $x = 4 - 2^x$ which lies between 1 and 2, by iteration method correct upto four decimal places. 6

16. Establish the Regula-Falsi method and also discuss the convergence of this method. 4+2

17. Write down a program in ANSI C for the fourth order Runge-Kutta method to compute $y(1.3)$ from $\frac{dy}{dx} = x^2 + y^2$ with $y(1) = 0$. 6

18. Solve the differential equation $\frac{dy}{dx} = x^2 + y$, $y = 1$ when $x = 0$ by Euler's modified method for $x = 0.02$, by taking $h = 0.01$. 6

19. Write a computer program in ANSI C for computing the sum of the series $1 + x + x^2 + x^3 + \cdots$. 6

20. Write a computer program in ANSI C to obtain the product of the matrices $[a_{ij}]_{m\times n}$ and $[b_{ij}]_{n\times p}$. 6
