HISSAN CENTRAL EXAMINATION - 2080 (2024)

Grade : XII **F.M.: 75**

Time : 3 hrs

COM. MATHEMATICS (0081 D1)

Candidates are required to give their answers in their own words as far as practicable.
*Attempt **ALL** Questions.*

GROUP A [11 × 1 = 11]

Rewrite the correct options of each questions in your answer sheet.

1. How many ways can 4 ribbons can be distributed among 5 women where each woman eligible for all ribbons ?
   a) 9 b) 20 c) 125 d) 625
2. Which one of the following is the sum of the binomial coefficient in the expansion of $(1+x)^n$
   a) 0 b) 2^n c) $2^n - 1$ d) 2^{n-1}
3. If $\frac{\cos C}{2}$ = sin A .cosB in a triangle ABC then the triangle has .
   a) a= b=c b) a = b c) b= c d) c = a
4. The slope of normal to the circle $x^2 + y^2 - 25 = 0$ at the contact point (3,4) of tangent is
   a) $\frac{4}{3}$ b) $-\frac{4}{3}$ c) $\frac{3}{4}$ d) $-\frac{3}{4}$
5. What is the area of a triangle with vertices (1,-1,0), (0, -1, 0) and (0,0,1) ?
   a) 1 sq. unit b) $\frac{1}{2}$ sq. units c) $\sqrt{2}$ sq .units d) $\frac{1}{\sqrt{2}}$ sq .units
6. A die is rolled once. What is the conditional probability that face turned up is a prime number given that the outcome is an even number?
   a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{6}$
7. What is the value of $\int \frac{1}{x^2-a^2}\ dx$?
   a) $\frac{1}{2a}\log\frac{x+a}{x-a}$ + C b) $\frac{1}{a}\log\frac{x+a}{x-a}$ + C
   c) $\frac{1}{2a}\log\frac{x-a}{a+x}$ + C d) $\frac{1}{2a}\log\frac{x+a}{a-x}$ + C
8. Which one of following is equal to $\lim_{x\to 0}\frac{tanx-x}{x-sinx}$?
   a) 0 b) 1 c) 2 d) 3
9. if the radius of the circle increases from 3cm to 3.01 cm, then which one of following is the an approximate change in $area$?
   a) 0.0601π cm^2 b) 0.06π cm^2 c) 0.06π m^2 d) 0.601π cm^2
10. The integrating factor of the differential equation $x\frac{dy}{dx} - y = x^2$ is
    a) x b) $\frac{1}{x}$ c) -x d) $-\frac{1}{x}$
11. The optimal value of the objective function is obtained when all entries in the last row the simplex tableau is
    a) Negative b) positive c) non-positive d) non negative

    OR,

    A bullet of mass of 15 g is fired from a rifle of mass of 3kg with a velocity of 100 km h-1 . The velocity of recoil of the rifle is
    a) 0.005 km h^{-1} b) 0.05 km h^{-1} c) 0.5 m h^{-1} d) 0.5 km h^{-1}

GROUP B [8 × 5=40]

12. a) What is the sum of the cubes of first n natural number? [1]
    b) What is the sum of first n an even number? [1]
    c) Write the general term of $(a+x)^n$ [1]
    d) Write the series of $\log_e(1+x)$ in expanded form [1]
    e) Write the exponential series of e^x in expanded form [1]
13. a) If l, ω and ω^2 are cube roots of unity, find the value of $(1-\omega)(1-\omega^2)(1-\omega^4)(1-\omega^8)$ [2]
    b) Solve the following system of equation by using Cramer's Rule [3]
    x + 2y - z = 8, 2x – y + z = 9, 3x - y = 1 + z
14. a) If (a + b + c) (a – b + c) - 3ac = 0 , find angle B of the triangle ABC. [2]
    b) Find the equation of the ellipse in the standard form passing through the points (1,4) and (-3,2) [3]
15. a) Two concentric circles are expanding in such way that the radius of inner circle is increasing at the rate of 12 cm/sec and that of the outer circle at the rate of 9cm/sec. At certain time, the radii of the inner and the outer circle are 21cm and 35 cm respectively. At that time, is the area between the circles increasing or decreasing? How fast ? [3]
    b) Find the area of triangle PQR formed by the points P(2,3,1), Q(1,2,3) and (1, 1,1) by using vector method. [2]

16. a) What is slope of tangent when tangent makes obtuse angle on x axis. [1]

b) Write one difference between differentiation and integration o a function [1]

c) Write the integral of $\int \frac{dx}{\sqrt{x^2+a^2}}$ [1]

d) In the expression $\int f(x)dx$ = F(x) +C , what is the relation between f(x) and F(x) from differentiation point of view? [1]

e) What is derivative of $\tanh^{-1} x$? [1]

17. The city of council of Bhaktapur has gathered data on number of minor traffic accidents and the number of youth football games that occurred in town over weekends as:

Football games	10	12	13	12	16	15
Minor accident	40	38	43	45	37	43

a Calculate the Pearson's coefficient of correlation [2]

b) Predict the number of minor traffic accidents that will occur at weekend during where number of football game is 40. [3]

18. a) Evaluate : $\int \frac{dy}{\sqrt{y+2}(11+y)}$ [2]

b) Solve by separation of variables of the equation
$\sin x \frac{dy}{dx}$ - x sin x + y cosx = 0 [3]

19. a) If R be the horizontal range and t be the time of flight of projectile, show that $\tan\alpha = \frac{gT^2}{2R}$, where α is the angle of projection. [2]

b) Three forces A, B and C acting at P along PX, PY, PZ where P is the in-centre of triangle XYZ , are in equilibrium. Show that
$\frac{A}{\cos\frac{X}{2}} = \frac{B}{\cos\frac{Y}{2}} = \frac{C}{\cos\frac{Z}{2}}$ [3]

OR

a) Solve the following system of equations by Gauss- Seidel method [2]
5 x - 2y - 6 =0, 7x +5 y = 24

b) Using simplex method to maximize Z = 2x + 3y subject to
5x + 2y$\leq$ 2 , $-y-2x \geq -1$ and x, y $\geq$0 [3]

GROUP C [3 × 8=24]

20. a) If $(1+x)^n = C_0 + C_1 x + C_2x^2 + \ldots \ldots + C_nx^n$, prove that
$C_0 + 4C_1 + 7C_2 + \ldots \ldots + (3n+1)C_n = (3n+2)2^{n-1}$ [3]

b) Using principle of mathematical induction, show that :
$n^2 > 2n + 1$ for all n $\geq$ 3 [3]

c) Find the square roots of $2 + 2\sqrt{3}$ by using De-Moivre's theorem [2]

21. a) Find the the equation of tangents to the parabola x^2 =16y makes angle of 45^0 with the straight line x –3y +5 =0 [3]

b) If A =30^0, b = $\sqrt{3}$ and a = 1 in a triangle ABC, identify the types of triangle. [2]

c) Prove that by vector method sin (A-B) = sinA.cosB - cosA.SinB [3]

22. a) Define order and degree of differential equation with an example .
Integrate the partial fraction $\int \frac{2x^2}{(2x+1)(x^2+1)}$ dx [1+2]

b) Find the value of $\lim_{x\to 0}\left(\frac{(e^x-1)\tan x}{x^2}\right)$ by using L Hospital's rule [2]

c) An equation relating to stability of an aero plane is
$\frac{du}{dt} + u.M = a\cos\theta$, where u is the velocity and a, θ and M are constants. Under which condition the solution of the equation does not exist ? Give reason. [3]

THE END