Question Paper

Exam Date & Time: 25-Jul-2024 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER BSc HEALTH SCIENCES DEGREE EXAMINATION - JULY 2024
SUBJECT: BHS-106 - CALCULUS AND STATISTICS
(OLD SCHEME)

Marks: 75 **Duration: 180**

Answer all the questions.

1A) **Find the local maxima and local minima values, if any, of the function** **(2)**

$f(x) = 2x^3 - 15x^2 + 36x + 1.$

1B) If $\vec{a} = (-1, 1, 2), \vec{b} = (3, 2, -1)$ and $\vec{c} = (-5, 1, 2)$ find $\vec{a} . (\vec{b} + \vec{c})$ **(2)**

1C) Differentiate $(\log x)^{\cos x}$ w.r.t x **(2)**

1D) Integrate: $\int \frac{\sec^2 x}{\csc^2 x} dx.$ **(2)**

1E) Calculate the geometric mean and the harmonic mean from the following data: **(2)**

Height	110	115	118	119	120
No. of students	4	11	21	6	2

1F) If x and y are connected parametrically by $x = 2at^2$ and $y = at^4$, find $\frac{dy}{dx}$. **(2)**

1G) Find the general solution of the ODE **(2)**

$$\frac{dy}{dx} = \frac{x+1}{2-y}, \; y \neq 2.$$

1H) A die is thrown. Let D denote the event where the outcome is less than 4, E denote the event where the outcome is an even number greater than 4 and F denote the event where the outcome is a number not less than 3. **(2)**

a) Find $D \cap E, D - E, E \cap F^c$.
b) Assuming that all outcomes of the die are equally likely, find the probability of all the above events in a).

1I) Find the angle between the unit vectors $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j})$ and $\frac{1}{\sqrt{2}}(\hat{i} - \hat{j})$. **(2)**

1J) Find $\int x \sin x \, dx$ (2)

1K) **A man of height 2m walks at a uniform speed of 5 kmph away from a lamp post which is 6m high. Find the rate at which the length of his shadow increases.** (2)

1L) Find the mean deviation about the mean for the following data:- (2)

x_i	2	5	6	8	10	12
f_i	2	8	10	7	8	5

1M) For a distribution, the mean is 10, variance is 16, coefficient of skewness γ_1 is +1 and coefficient of kurtosis β_2 is 4. Obtain the second, third and fourth central moment and the first moment about the origin. (2)

1N) **One card is drawn from a well shuffled deck of 52 cards. If each outcome is equally likely, calculate the probability that the card will be** (2)
i) a diamond
ii) not an ace.

2A) Find the equation of the tangent to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 5$ at the point $(0,5)$. (3)

2B) Find mean, median and mode for the following data : (3)

Percentage marks	0 – 10	10-20	20-30	30-40	40-50	50-60	60-70
No of students	4	9	19	20	18	7	3

2C) Integrate : $\int sin(4x)\, sin(3x)\, dx$ (3)

2D) Calculate Pearson's coefficient of skewness:- (3)

No. of children per couple	0	1	2	3	4	5	6	7
No. of couples	10	15	28	20	10	7	2	2

3A) The following are the runs scored by two batswomen A and B in 10 innings. (5)

A	101	27	0	36	82	45	7	13	65	14
B	97	12	40	96	13	8	85	8	56	15

i) Who is a better run scorer? (Use the arithmetic mean to compare)
ii) Who is more consistent in scoring? (Use the coefficient of variation to compare).

3B) Calculate the correlation coefficient between X and Y from the following data. (5)

X	31	32	33	34	35	36	37	38	39	40
Y	11	12	13	14	15	16	17	18	19	20

Comment about the nature of the correlation between X and Y.

------**End**------