

# HERAMB COACHING CLASSES

**XII/ MATHS**

**Marks: 50**

**Duration: 3 Hours**

**Date: 08-02-19**

**NOTES:** i) All questions are compulsory.

ii) Figures to the right indicate full marks.

iii) Graph paper is not necessary for LPP. Only rough sketch of the graph is expected.

iv) Use of logarithmic table is allowed.

v) Answers to the questions in Section-I and Section-II should be written in two separate answer book.

vi) Questions from section-I attempted in answer book of section-II and vice versa will not be assessed/ not given any credit.

vii) Answer to every question must be written on a new page.

## SECTION- I

**Q.1 Attempt any 6 of the following:**

**(12)**

i) Find  $x, y, z, w$ , if  $\begin{pmatrix} x+y & x-y \\ y+z+w & 2w-z \end{pmatrix} = \begin{pmatrix} 2 & -1 \\ 9 & 5 \end{pmatrix}$ .

ii) Express the truth of the following statement with the help of Venn diagrams:

a) No circles are polygon

b) If a quadrilateral is rhombs, then it is a parallelogram.

iii) Find the points of discontinuity, if any, for the function:

$$f(x) = \frac{x^2-9}{\sin x-9}$$

iv) Write negations of the following statements:

a) The number 6 is an even number or the number 25 is the perfect square.

b) If  $x \in A \cap B$ , then  $x \in A$  and  $x \in B$ .

v) Evaluate:  $\int \cos^2 x dx$ .

vi) Find  $\frac{d^2y}{dx^2}$ , if  $y = \log x$ .

vii) Evaluate:  $\int \frac{e^x+1}{e^x+x} dx$ .

viii) Find  $\frac{dy}{dx}$ , if  $x^3 + y^2 + xy = 10$ .

**Q.2 (A) Attempt any 2 of the following:**

**(6)**

i) Find the inverse of the matrix  $\begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{pmatrix}$  by the adjoint method.

ii) If  $f(x) = \frac{e^{2x}-1}{ax}$ , for  $x < 0, a \neq 0$

$$=1, \text{ for } x = 0$$

$$= \frac{\log(1+7x)}{bx}, \text{ for } x > 0, b \neq 0$$

Is continuous at  $x=0$ , then find a and b.

iii) Demand function  $x$ , for a certain commodity is given as  $x=200-4p$ , where  $p$  is a unit price.

- Find: a) elasticity of demand as function of p.  
 b) elasticity of demand when  $p=10$ , interpret your result.

**(B) Attempt any 2 of the following:**

**(8)**

i) Using the truth table, verify that:

$$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r).$$

ii) If the demand function is  $D = 150 - p^2 - 3p$ , find marginal revenue, average revenue and elasticity of demand for price  $p=3$ .

iii) Evaluate:  $\int_0^{\frac{\pi}{2}} \frac{\sin x \cdot \cos x}{1 + \sin^4 x} dx$ .

**Q.3 (A) Attempt any 2 of the following:**

**(6)**

i) Solve the following equation by reduction method:

$$x + 3y + 3z = 16$$

$$x + 4y + 4z = 16$$

$$x + 3y + 4z = 19$$

ii) If the function  $f(x) = \frac{15^x - 3^x - 5^x + 1}{x \tan x}$ ,  $x \neq 0$  is continuous at  $x=0$ , then find  $f(0)$ .

iii) Examine the function  $f(x) = x + \frac{25}{x}$  for maxima and minima.

**(B) Attempt any 2 of the following:**

**(8)**

i) Find the volume of solid obtained by the complete revolution of the ellipse  $\frac{x^2}{36} + \frac{y^2}{25} = 1$  about X-axis.

ii) If  $x^3 y^5 = (x + y)^8$ , then show that  $\frac{dy}{dx} = \frac{y}{x}$ .

iii) Evaluate:  $\int \frac{(1 + \log x)}{x(2 + \log x)(3 + \log x)} dx$ .

**SECTION- II**

**Q.4 Attempt any 6 of the following:**

**(12)**

i) The ratio of number of boys and girls in a school is 3:2. If 20% of the boys and 30% of the girls are scholarship holders, find the percentage of the students who are not scholarship holders.

ii) Calculate crude death rates (CDR) for district A:

**District A**

Age group (in years)	Number of persons (in thousands)	Number of deaths
0 – 15	1	20
15 – 60	3	30
60 and above	2	40

iii) What is the sum due on Rs.5000, for 4 months, at 12.5% p.a., simple interest?

iv) The following data gives the marks of 20 students in Mathematics (X) and Statistics (Y) each out of 10, expressed as (x, y). Construct ungrouped frequency distribution considering single number as a class:

(2, 7), (3, 8), (4, 9), (2, 8), (2, 8), (5, 6), (5, 7), (4, 9), (3, 8), (4, 8), (2, 9), (3, 8), (4, 8), (5, 6), (4, 7), (4, 7), (4, 6), (5, 6), (5, 7), (4, 6).

v) A wholesale allows 25% trade discount and 5% cash discount. What will be the net price of an article marked at Rs. 1600?

vi) Verify the following function, which can be regarded as p.m.f. for the given value of X:

<b>X=x</b>	-1	0	1
<b>P(x)</b>	-0.2	1	0.2

vii) Solve the following minimal assignment problem:

<b>Machines</b>	<b>Jobs</b>		
	<b>I</b>	<b>II</b>	<b>III</b>
$M_1$	1	4	5
$M_2$	4	2	7
$M_3$	7	8	3

viii) If X has Poisson distribution with parameter  $m = 1$ , find  $P[X \leq 1]$ .

[Use  $e^{-1} = 0.367879$ ].

**Q.5 (A) Attempt any 2 of the following:**

**(6)**

i) Find the present value of annuity immediate of Rs. 18000 p.a. for 3 years at 9% p.a. compounded annually. [Given:  $(1.09)^{-3} = 0.7722$ ]

ii) Complete the following life table:

<b>x</b>	<b><math>l_x</math></b>	<b><math>dx</math></b>	<b><math>qx</math></b>	<b><math>px</math></b>	<b><math>lx</math></b>
4	9100	60	?	?	?
5	?	45	?	?	?

iii) Given that  $r = 0.4$ ,  $\sum(x - \bar{x})(y - \bar{y}) = 108$ ,  $\sigma_y = 3$  and  $\sum(x - \bar{x})^2 = 900$ .

Find the number of pairs of observations.

**(B) Attempt any 2 of the following:**

**(8)**

i) Find mean and standard deviation of the continuous random variable X whose p.d.f. is given by

$$f(x) = 6x(1 - x), \quad 0 < x < 1$$

=0, otherwise.

ii) Solve the following LPP graphically:

$$\text{Minimize } z = 3y + 5x,$$

$$\text{Subject to } 2x + 3y \geq 12, \quad -x + y \leq 3, \quad x \leq 4, \quad y \geq 3.$$

iii) We have seven jobs each of which has to go through two machines  $M_1$  and  $M_2$  in the order  $M_1 - M_2$ .

Processing times (in hours) are given as:

Jobs	A	B	C	D	E	F	G
Machine $M_1$	3	12	15	6	10	11	9
Machine $M_2$	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time 'T' and idle time for each machine.

**Q.6 (A) Attempt any 2 of the following:**

**(6)**

i) Compute the age specific death rate of the following data:

Age group (in years)	Population (in thousands)	Number of deaths
Below 5	15	360
5 – 30	20	400
Above 30	10	280

ii) If the rank correlation coefficient is 0.6 and the sum of squares of differences of ranks is 66, then find the number of pairs of observations.

iii) The equations of the two regression lines are  $2x+3y-6=0$  and  $5x+7y-12=0$ .

Find: (a) correlation coefficient.

(b)  $\frac{\sigma_x}{\sigma_y}$ .

**(B) Attempt any 2 of the following:**

**(8)**

i) John and Mathew started a business with their capitals in the ratio 8:5. After 8 months, John added 25% of his earlier capital as further investment. At the same time, Mathew withdrew 20% of his earlier capital. At the end of the year, they earned Rs.52000 as profit. How should they divide the profit between them?

ii) A departmental store gives training to the salesman in service followed by a test. It is experienced that the performance regarding sales of any salesman is linearly related to the scores secured by him. The following data gives the test scores and sales made by nine (9) salesman during a fixed period:

Test scores (X)	16	22	28	24	29	25	16	23	24
Sales (Y) (Rs. In hundreds)	35	42	57	40	54	51	34	47	45

a) Obtain the line of regression of Y on X.

b) Estimate Y when X=17.

iii) Three different aeroplanes are to be assigned to carry three cargo consignment with the view to maximize profit. The profit matrix (in lakhs of Rs.) is as follows:

Aeroplanes	Cargo consignment		
	$C_1$	$C_2$	$C_3$
$A_1$	1	4	5
$A_2$	2	3	3
$A_3$	3	1	2

How should the cargo consignment to be assigned to the aeroplanes to maximize the profit?

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