Instructions :   (1)   All Questions are *compulsory.*

(2)   Answer each next main Question on a new page.

(3)   Illustrate your answers with neat sketches wherever necessary.

(4)   Figures to the right indicate full marks.

(5)   Assume suitable data, if necessary.

(6)   Use of Non-programmable Electronic Pocket Calculator is permissible.

(7)   Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   **Attempt any TEN of the following :**   **20**

(a)   If f(x) = $3x^2 - 5x + 7$, show that f(-1) = 3f(1).

(b)   Evaluate : $\lim\limits_{x \to 3} \dfrac{x^2 - 9}{x - 3}$.

(c)   Find $\dfrac{dy}{dx}$ if x = r cos θ and y = r sin θ.

(d)   If y = $e^{\log x}$, find $\dfrac{dy}{dx}$.

(e)   Find $\dfrac{dy}{dx}$ if y = $\cos^{-1}$ (sin x).

(f) Evaluate : $\int \dfrac{x}{x+1}\, dx$.

(g) Evaluate : $\int (x^m + m^x + m^m)\, dx$.

(h) Evaluate : $\int \dfrac{1}{\sin^2 x \cdot \cos^2 x}\, dx$.

(i) Find number of observations if sum of all the observations is 1728 and A.M. of observations is 64.

(j) Find median and mode for the following data :

12, 18, 9, 14, 24, 9, 5, 19, 9, 10, 20, 13.

(k) Find range and coefficient of range for the following data :

Marks :	0-9	10-19	20-29	30-39	40-49
frequency :	7	15	6	11	5

(l) Define : (i) Quartile deviation, (ii) Standard deviation.

2. Attempt any FOUR of the following : **16**

(a) If $f(x) = \dfrac{x+5}{3x-4}$ and $t = \dfrac{5+4x}{3x-1}$, show that $f(t) = x$.

(b) Evaluate : $\lim\limits_{x \to 4} \dfrac{x^4 - 64x}{\sqrt{x^2 + 9} - 5}$.

(c) Evaluate : $\lim\limits_{x \to 0} \dfrac{e^{3x} - e^{2x} - e^x + 1}{x^2}$

(d) Find $\dfrac{dy}{dx}$ if $y = (3x + 2)^{2/3} \cdot (2x - 1)^{3/2} \cdot \sqrt{(1 - x)}$.

(e) Find $\dfrac{dy}{dx}$ if $y = \tan^{-1} \left[\dfrac{\cos x - \sin x}{\cos x + \sin x} \right]$.

(f) If $x^2 + y^2 = 4xy$ find $\dfrac{dy}{dx}$ at $(2, -1)$.

3. **Attempt any FOUR of the following :** 16

(a) Find the equations of tangents to the curve $y = x^2 - 2x - 3$ where it meets the x-axis.

(b) Divide 80 into two parts such that their product is maximum.

(c) Evaluate : $\displaystyle\int \dfrac{1}{\sin^2 x \cdot \cos^2 x}\, dx$.

(d) Evaluate : $\displaystyle\int \dfrac{\log x}{x(2 + \log x)(3 + \log x)}\, dx$.

(e) Evaluate : $\displaystyle\int x^2 \cdot \sin 3x\, dx$.

(f) Evaluate : $\displaystyle\int \dfrac{1 - \tan x}{1 + \tan x}\, dx$.

4. **Attempt any FOUR of the following :** **16**

(a) Evaluate : $\displaystyle\int_0^{\pi/2} \frac{\cos x}{4 - \sin^2 x}\,dx.$

(b) Evaluate : $\displaystyle\int \frac{x+1}{x^2\,(x-2)}\,dx.$

(c) The following is a record of sales 1 to the nearest hundreds of rupees) of a shop on 50 days. Tabulate the data in the form of a frequency distribution, take the classes as 60-69, 70-79, … etc.

$$
\begin{array}{cccccccccc}
66 & 73 & 93 & 107 & 112 & 75 & 78 & 69 & 95 & 72 \\
80 & 88 & 96 & 109 & 102 & 84 & 84 & 106 & 91 & 75 \\
91 & 92 & 102 & 91 & 101 & 90 & 77 & 105 & 90 & 86 \\
113 & 101 & 114 & 72 & 77 & 118 & 95 & 63 & 99 & 82 \\
100 & 106 & 87 & 89 & 92 & 107 & 111 & 76 & 83 & 86 \\
\end{array}
$$

Also find class-marks and less than cumulative frequency.

(d) Find the mean life of lamps from the following data :

C.I. Life (in hours) :	0-100	100-200	200-300	300-400	400-500	500-600
fi :	8	25	45	12	7	3

(e) Find mode for the following data which is a age distribution of 21 employees of a small company :

Age (in years)	20-30	30-40	40-50	50-60	60-70
No. of employees :	3	5	7	4	2

(f) Find mode graphically for the following data :

Marks :	0-10	10-20	20-30	30-40	40-50	50-60
No. of students :	9	25	45	12	7	3

5. **Attempt any FOUR of the following :** 16

(a) The following data refer to the weight distribution of 100 employees of a company.

Weight (in kg.): 45-50 50-55 55-60 60-65 65-70 70-75 75-80

No. of   6   8   15   26   20   14   11
employees :

Draw an orgive curve and determine the medium.

(b) Find Q.D. and coefficient of Q.D. for the following data :

Class Interval : 0-10 10-20 20-30 30-40 40-50 50-60

Frequency :   12   18   27   20   17   6

(c) Find the standard deviation for the following data :

Weekly wages (in ₹) : 0-10 10-20 20-30 30-40 40-50

No. of workers :   5   8   15   16   6

(d) The following data refer to the weight distribution of 100 students in a class. Calculate the combined standard deviation for the given data :

	Number	Mean wt. (in kg.)	S.D. of wt. (in kg.)
Boys	55	61	8
Girls	45	51	6

(e) The two sets of observations are given below :

Set I	Set II
$\overline{X} = 34.5$	$\overline{X} = 28.5$
$\sigma = 5.0$	$\sigma = 4.5$

Which set of two sets has greater variability ?

P.T.O.

(f) Find coefficient of variance for the following data :

Class-interval :	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Frequency :	5	9	14	20	25	15	8	4

6. **Attempt any FOUR of the following :** **16**

(a) If n = 20, Σx = 400, Σy = 510, Σxy = 10060, Σx^2 = 9140, Σy^2 = 21340, find coefficient of correlation for the data.

(b) Calculate the coefficient of variation for the following age distribution of 125 persons :

Age under (in yrs.) :	10	20	30	40	50	60	70	80
No. of persons :	15	30	53	75	100	110	115	125

(c) Calculate Karl Pearson's correlation coefficient from the following elementary data :

x :	3	7	9	10	14
y :	5	6	12	8	16

(d) Calculate Spearman's rank correlation coefficient for the following data :

Marks in Economics :	32	58	67	44	49	51	56
Marks in Politics :	43	70	65	49	68	53	55

(e) Find the regression line of y on x for the following data :

x :	18	26	28	31	25	19	35
y :	11	16	19	17	14	11	24

(f) The equations of two lines of regression obtained in an analysis are :

$2x + 3y - 8 = 0$ and $x + 2y = 5$ Find

(i) $\bar{x}$

(ii) $\bar{y}$

(iii) Regression coefficients like b_{yx} and b_{xy}.

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