

Duration: 3 Hrs

Maximum marks: 80

**Note:** All Questions are compulsory  
Use of simple calculator is allowed  
Figure at right indicate maximum marks

**Q.1 (a) Attempt any 7 [2 marks each]****[14]**

- (i) If  $y=x^5$ , then  $y_5 = ?$   
(a) 20 (b) 60 (c) 120 (d) 150
- (ii) The value of  $\int_1^3 (x^2) dx$  is:  
(a) 26/3 (b) 27/3 (c) 6 (d) 5
- (iii) The differential equation for the function  $y^2 = 4ax$  is  
(a)  $2x \frac{dy}{dx} - y = 0$  (b)  $2x^2 \frac{dy}{dx} - y = 0$  (c)  $2x \frac{dy}{dx} + y = 0$  (d)  $2x \frac{dy}{dx} - y^2 = 0$
- (iv) The inverse of the matrix  $A = \begin{bmatrix} 3 & -2 \\ 5 & 4 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 4 \\ 6 & -7 \end{bmatrix}$  then  $A - 4B + 7I$  (where  $I$  is the unit matrix of order 2):  
(a)  $\begin{bmatrix} 6 & -18 \\ -19 & 39 \end{bmatrix}$  (b)  $\begin{bmatrix} 6 & -18 \\ 19 & 39 \end{bmatrix}$  (c)  $\begin{bmatrix} 6 & 18 \\ -19 & 39 \end{bmatrix}$  (d)  $\begin{bmatrix} 6 & 18 \\ 19 & 39 \end{bmatrix}$
- (v) If Median and S.D are 50 and 20 respectively. If each item is increased by 5 then the Median and S.D will be;  
(a) 50,20 (b) 45,20 (c) 55,25 (d) 55,20
- (vi) If 75% of the items lies above 40 and 75% of the items lies below 60, then co-efficient of Quartile deviation is  
(a) 0.46 (b) 0.64 (c) 0.04 (d) 0.20
- (vii) Two dice are thrown simultaneously. What is the probability of obtaining sum of the numbers less than 11.  
(a) 17/18 (b) 1/12 (c) 11/12 (d) None of these
- (viii) For a Poisson variate  $X$ ,  $P(X=1) = P(X=2)$ . Find  $P(X=4)$   
(a) 0.090224 (b) 0.05288 (c) 0.021100 (d) 0.07684
- (ix) The table value for a Normal distribution,  $P[Z \geq 1.04] = 0.14917$  then  $P[Z \leq 1.04] =$  is;  
(a) 0.35083 (b) 0.85083 (c) 0.29834 (d) 0.64917

**(b) Attempt any 1:****[1]**

- (x) If  $A = \begin{bmatrix} 7 & 3 & 4 \\ -2 & -1 & 0 \\ 5 & 3 & 6 \end{bmatrix}$ , then  $(A^T)^T$  is \_\_\_\_\_.  
(a)  $A$  (b)  $A^T$  (c)  $A \cdot A^T$  (d) 0.

- (xi) To test the hypothesis of equality among several variables the best measure is:  
(a) Z-test (b) t-test (c) Chi-square test (d) ANOVA.

- Q2. (a) Attempt any two (4 marks each) [8]**
- (i) Find the  $N^{\text{th}}$  derivative of  $y = e^x \cdot \cos x \cdot \sin 3x$
  - (ii) State the Lagrange's Mean Value theorem. Use it to verify for  $f(x) = x^2 - 5x + 6$  in  $[2, 4]$
  - (iii) Using Maclaurin's series, give the expansion of  $f(x) = \sin x$

- (b) Attempt any one (3 marks) [3]**
- (i) For  $f(x) = \left[\frac{1}{x^2-1}\right]$ , find  $y_n$ . Later, find  $y_4$  (i.e  $n=4$ ) at  $x=0$ .
  - (ii) Verify Rolle's theorem for the function  $f(x) = x^2 - 3x + 2$  in  $[1, 2]$

- Q3. (a) Attempt any two (4 marks each) [8]**
- (i) Evaluate:  $\int_0^{\frac{\pi}{2}} \sin^4 x \, dx$
  - (ii) Evaluate:  $\int e^x \cos x \, dx$ .
  - (iii) Find the volume generated by revolving the arc of the curve  $y = \sin x$ , between the  $x=0$  and  $x = \pi$

- (b) Attempt any one (3 marks) [3]**
- (i) Evaluate:  $I = \int \frac{e^x}{16 - e^{2x}} \, dx$ .
  - (ii) Find the length of the curve  $x = a \sin \theta$ ,  $y = a \cos \theta$  from  $\theta = 0$  to  $\theta = \frac{\pi}{4}$

- Q4. (a) Attempt any one (4 marks each) [4]**
- (i) Solve  $(1-x)dy - (1+y)dx = 0$ . Also find the particular solution, if  $y = 2$  when  $x = 1$ .
  - (ii) Solve the following homogeneous differential equations:  $\frac{dy}{dx} = \frac{xy + y^2}{x^2 + xy}$

- (b) Attempt any one (3 marks) [3]**
- (i) Form the differential equation for  $y = A \cos x + B \sin x$ , where A and B are constants.
  - (ii) Solve  $ydx - xdy = 0$

- Q5. (a) Attempt any one (4 marks each) [4]**
- (i) By using the Adjoint method, find the inverse of the matrix  $A = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 3 & 0 \\ 5 & 2 & -1 \end{bmatrix}$

- (ii) Solve by using the properties of determinant:  $\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = 0$

- (b) Attempt any one (3 marks) [3]**
- (i) Find the Rank of the matrix  $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$

- (ii) If  $A = \begin{bmatrix} 1 & 2 \\ -3 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$  then find  $A^2 - 2B + I$ .

Q6. (a) Attempt any one ( 4 marks each) [4]

(i) Calculate the median income from the following data:

Income (in '000 Rs)	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Income	10	15	30	50	35	15	5

(ii) The following data gives the weight distribution of students in a class. Find the average Weight of the students .

Wt.(in kgs.)	41	42	43	44	45	46	47	48
No. of students	3	6	8	15	17	12	5	4

(b) Attempt any one(3 marks) [3]

(i) The A.M of 50 observations was found to be 115. It was later noticed that the observation 78 was misread as 87. Find the correct value of the A.M.

(ii) The following are the marks of three students A, B,C in 4 subjects P,Q,R and S respectively. The weights of the subjects are given. Decide which of the three students is the best.

	P	Q	R	S
Marks of A	28	30	40	20
Marks of B	35	25	20	15
Marks of C	30	35	30	20
Weight	4	3	2	1

Q7. (a) Attempt any two ( 4 marks each) [8]

(i) The no. of runs scored by two cricketers A and B in 10 innings of 5 test matches are shown below; Find which cricketer is more consistent.

A	5	20	90	76	102	90	6	108	20	16
B	40	35	60	62	58	76	42	30	30	20

(ii) Hundred students appeared for two examinations. 60 passed the first, 50 passed the second and

30 passed in both. Find the probability that student selected at random

(a) Passed in at least one examinations.

(b) Failed in both the examinations.

(iii) It is stated that optical lenses supplied by a manufacturer are found to be defective follows Poisson distribution, with mean 4. What is the probability that form a random sample of lenses

(1) 3 or more are defective. (2) at the most 2 lenses are defective?

(b) Attempt any one(3 marks) [3]

(i) Find k and hence find the expected value of a random variable x and variance for the probability distribution:-

x	2	3	4	5
P(x)	0.1	k	0.4	0.3

- (ii) Calculate M.D. from mean and corresponding coefficient of M.D. for the following data representing daily wages (in Rs.) of workers in a factory:

Daily Wages(in Rs.)	63-67	68-72	73-77	78-82	83-87	88-92	93-97
No. of Workers	2	22	19	14	9	4	3

**Q8. (a) Attempt any two ( 4 marks each)**

[8]

- (i) In a cross-breeding experiment with plants at certain species 240 offspring were classified in 4 classes w.r.t the structure of their leaves as follows:

Class	I	II	III	IV	Total
Frequency	21	127	40	52	240

According to theory of heredity, the probabilities of the four classes should be in the ratio 1:9:3:3. Are these data consistent with theory?(Given that the table value of  $\chi^2$  with 3 d.f at 5% l.o.s. is 7.815)

- (ii) In an examination in Psychology 12 students in one class had a mean grade of 78 with a standard deviation of , while 15 students in another class had a mean grade of 74 with a standard deviation of 8. Is there a significant difference between the means of the two groups? (Given:  $t = 2.060$  at 5% level of significance and 25 degrees of freedom.)
- (iii) Following are weekly sales records (in '000s of Rs.) of 3 salesmen A,B,and C of a company during 15 sales calls:-

<b>A</b>	25	30	36	38	31
<b>B</b>	31	39	38	42	35
<b>C</b>	24	30	28	25	28

Using ANOVA technique, determine whether Sales of the three salesmen are different. Given value of F for (2,12) d.f. at 5% level of significance is 3.89

**(b) Attempt any one(3 marks)**

[3]

- (i) Two random samples of 10 & 14 observations were drawn. The sum of squares of deviations from means for each sample were 130.5 & 148.5 resp. Test whether the difference is significant at 5% l.o.s. [  $F_{0.05}=(9,13)=2.71$  ]
- (ii) From a random sample of size  $n=9$  is drawn from normal population gave the following observations:  
72, 74, 68, 70, 61, 63, 69, 73 and 71.  
To test:  $H_0: \sigma^2 = 36$  Vs  $H_1: \sigma^2 \neq 36$  (Use at 10% l.o.s.)  
(Given that table value of  $\chi^2$  with 8 d.f at 5% l.o.s. is 2.306)