



September 06, 2005

**QUANTITATIVE METHODS**

**(MARKS 100)**

**Module A**

**(3 hours)**

Q.1 Determine which pairs of the given lines are parallel, perpendicular or neither. Give reason in each case and show your calculations:

(a)  $3x = y + 7$  and  $x + 3y = 7$  **(02)**

(b)  $x + y = 4$  and  $x - 2y = 3$  **(02)**

(c)  $2x + 3y = 5$  and  $4x + 5 = -6y$  **(02)**

Q.2 (a) Solve the following equation:  
 $4m^4 - 9m^2 + 2 = 0$  **(04)**

(b) The sum of 16 terms of an Arithmetic Progression, whose last term is 250, is 2800. Find the first term and common difference. **(04)**

Q.3 (a) Bashir owes Rs.50,000 to Arshad due to a court decision. The money must be paid in 10 months with no interest. Suppose Bashir wishes to pay the money now. What amount should Arshad be willing to accept? Assume simple interest of 8% per annum. **(03)**

(b) Farhan borrowed Rs.100,000 for one year at 12% annual interest compounded monthly. The loan is to be paid in equal monthly installments.

(i) Determine the amount of each installment. **(02)**

(ii) Calculate principal repayment included in first installment. **(02)**

(iii) Find the total interest paid during the year. **(02)**

Q.4 (a) The demand function for a certain product is given by  

$$p = \frac{50,000 - x}{25,000}$$
 where  $p$  is the price in rupees and  $x$  is the demand  
 Find the marginal revenue when  $x = 10,000$  units. **(04)**

(b) A small company must hire expensive temporary staff to supplement its full-time staff. It estimates that the monthly costs,  $c(x)$ , are related to the number of full time employees by the function:

$$c(x) = 250x + \frac{16,000}{x} + 100$$

where  $x$  is the number of full time employees

How many full-time employees should the company have, to minimize the costs? **(07)**

(2)

- Q.5 (a) An investment group is planning to establish shopping centres in 5 markets. They have estimated the initial cost and the rent (both in rupees per square foot) for each centre, respectively, as follows:

Initial cost (in rupees)	180	100	80	100	100
Rent (in rupees)	27	15	10	20	17

Write this information first as a 5 x 2 matrix and then as a 2 x 5 matrix. (02)

- (b) Show that  $B^2 = B$ , where

$$B = \begin{bmatrix} 1 & 0 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 0 & 1 \end{bmatrix} \quad (04)$$

- Q.6 (a) Sketch the feasible region for the following set of constraints:

$$\begin{aligned} 3y - 2x &\geq 0 \\ y + 8x &\leq 52 \\ y - 2x &\leq 2 \\ x &\geq 3 \end{aligned} \quad (03)$$

- (b) Find the maximum value of the objective function  $Z = 5x + 2y$ , by determining the corner points of the feasibility region sketched in Q.6 (a). (07)

- Q.7 (a) A student received a grade of 79 in a final examination in mathematics for which the mean grade was 76 and the standard deviation was 10. In the final examination in economics, for which the mean grade was 91 and the standard deviation was 5, she received a grade of 92.

In which subject, her relative standing was higher. (03)

- (b) A firm manufactures refrigerators at three plant locations A, B and C. For each location, the firm maintains a record of the refrigerators made at that plant which require repair before expiration of warranty. Following is the summary of the information about repairs:

- Plant 'A' produces 30% of all refrigerators and has a repair rate before warranty expirations, of 5%.
- Plant 'B' produces 45% of all refrigerators and has a repair rate before warranty expiration, of 3 %.
- Plant 'C' produces 25% of all refrigerators and has a repair rate before warranty expiration, of 7%.

If a refrigerator requires repair before warranty expiration, what is the probability that it was manufactured at Plant 'B'? (03)

- Q.8 In an organization of 30 persons, sickness and absence records were kept daily for 3 months. The number of workers absent each day are shown below. Find the mean, variance and standard deviation of the number of employees absent per day.

No. of employees absent (x)	0	1	2	3	4	5	6 or more
No. of days (f)	44	19	10	8	7	3	0

**(04)**

- Q.9 A study by the transportation department on the effect of bus-ticket prices upon the number of passengers, produced the following data:

Ticket price in Rs. (x)	5	6	7	8	9	10	11	12
No. of Passengers (y)	800	780	780	660	640	600	620	620

- (a) Develop the least square regression line of y on x **(05)**  
 (b) How do you interpret the slope of the above regression line? **(01)**  
 (c) Estimate the number of passengers if the ticket price is 8.5 rupees. **(01)**

- Q.10 The following table contains the data on the heights and weights of a group of women:

Height (x in inches)	Weight (y in pounds)
65	140
69	150
62	110
71	170
66	120
68	150
70	150
67	130
63	120
65	100

Compute the co-efficient of correlation and co-efficient of determination and interpret your results. **(06)**

- Q.11 (a) Find the values of  $-Z$  and  $Z$  if the standard normal curve area between  $-Z$  and  $Z$  is 0.9700. **(02)**  
 (b) A normal distribution has a mean = 61.6. Find its standard deviation if 20% of the total area under the curve lies to the right of  $x = 70$ . **(02)**  
 (c) In an experiment to determine the amount of time required to assemble a toy, the assembly time was found to be a random variable having approximately a normal distribution with  $\mu = 27.8$  minutes and  $\sigma = 4.0$  minutes. What is the probability that this kind of toy can be assembled in less than 25.0 minutes? **(03)**

(4)

- Q.12 (a) The length of babies at birth has a mean,  $\mu = 19$  inches and a standard deviation,  $\sigma = 1.3$  inches. Samples of 100 babies are chosen:
- (i) Find the mean and standard deviation of the sampling distribution of means. **(02)**
  - (ii) What is the probability that one of the samples of 100 babies will have a mean less than 18.7 inches? **(03)**
- Q.12 (b) A survey is being planned to determine the mean amount of time, senior citizens (older than 60 years) watch T.V. A pilot survey indicated that the mean time per week is 12 hours with a standard deviation of 3 hours. It is desired to estimate the mean viewing time within a quarter hour. 95% confidence level is to be used. How many senior citizens should be surveyed? **(03)**
- Q.13 A random sample of the records of 300 students of a college shows that 213 of them have G.P.A greater than 2.5. Find a 90% confidence interval for the proportion of students of this college who have G.P.A greater than 2.5. Interpret your result. **(05)**
- Q.14 I.Q of students at a college are normally distributed with a mean = 112 and a standard deviation = 12. Professor Hameed believes that IQ of students in his Statistics class do not have a mean IQ of 112. To prove this point, a random sample of 5 students from Statistics class is chosen. Their IQ Scores were found to be 115, 124, 131, 129 and 120. Test the hypothesis that the mean IQ of the students of the class is the same as that of the population of students at the college. Use  $\alpha = 0.05$ . **(07)**

**(THE END)**