

March 11, 2001

QUANTITATIVE METHODS
FE-1 (PAPER-2) / MODULE "A" / SPECIAL MODULE

(MARKS 100)
(3 hours)

- Q.1(a) A bank charges mark-up @ Re.0.39 per day per Rs.1,000/-. Express rate of mark-up as percent per annum. (01)
- (b) Solve the following equation
 $2.5x^2 + 3.25x - 16.5 = 0$ (03)
- (c) Find the length of the straight line connecting points A and B having co-ordinates (2, -5) and (-4, 3) respectively. (03)
- (d) If $4 : a :: 5 : 8$, find "a" (01)
- (e) Cost of 3 pen and 8 pencils is Rs 100 whereas cost of 5 pen and 6 pencils is Rs.130. Find the cost of a pen and a pencil. (06)
- Q.2(a) Mr. B is employed as an executive and his present age is 50 years. His present saving is worth Rs.100,000. It is invested in a scheme @ 10% compounded annually. He is due to retire at the age of 60 years. He wishes to receive Rs.80,000/- per annum for 10 years after his retirement. The applicable interest rate then will be 9%. How much amount shall he save and deposit annually at the end of current year and next nine years i.e. upto his retirement to achieve his aim provided he can earn interest of 8% on his annual savings upto his retirement on annual compounding basis. (08)
- (b) A note bearing interest of Rs.10,000 at 8% compounded semi-annually for 6 years is discounted, after one year of its issue. Calculate the amount to be received if it is discounted @ 12% compounded annually. (04)
- Q.3(a) Given $y = U^6$ and $U = 3x^4 + 5$, find dy/dx (03)
- (b) A firm has established the following total revenue (TR) and total cost (TC) functions for its product:
 $TR = -0.2 Q^2 + 900 Q$
 $TC = 0.03 Q^3 - 0.2 Q^2 + 600$
Where Q represents the number of items
(i) find the corresponding marginal revenue and marginal cost functions
(ii) use the results of part (i) to find the quantity of the product corresponding to maximum profit. (03)
- (c) For the following function, find the second order derivative and evaluate it at $x = 2$
 $y = (2x + 3)(8x^2 - 6)$ (03)

(d) Given total cost functions

$$TC = 31 + 24Q - 5.5Q^2 + \frac{Q^3}{3},$$

find the relative minimum or maximum for the function.

Q.4 A factory produces Transformers and Switchgears. The production is carried out in two departments A & B. The machines in department A can work upto 6 hours per day whereas those in department B can work upto 7.5 hours per day. A transformer requires 4 hours in department A & 3 hours in department B, whereas a switch gear requires 2 hours in department A & 5 hours in department B. The profit margin on a transformer is Rs.5,000 and on a switch gear is Rs.6,000. How many transformers and switch gears may be produced to maximize profit in a month having 20 working days. (Use graphical method). (10)

How many machine hours will remain idle during the month in each department at the maximum level of profit. (02)

Q.5(a) A patient's blood pressure measured daily over several weeks averaged 182 with a standard deviation of 12.6, while that of another patient averaged 124 with a standard deviation of 9.4. Which patient's blood pressure is relatively more variable? (02)

(b) If the mean monthly salary paid to the three top executives of a firm is Rs.156,000. Can one of them receive a monthly salary of Rs.500,000? (02)

(c) Find the sample variance, sample standard deviation and co-efficient of variation for the following data:

Size of orders (x)	No. of orders (f)	
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20 < 30	3	
30 < 40	8	
40 < 50	12	
50 < 60	6	
60 < 70	1	(06)

(d) Compute the weighted aggregate price index for the year 2000 on the basis of year 1995 from the following data:

Commodity	Unit	Average monthly consumption per family	Average price in Rupees	
			1995	2000
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Milk	Litre	30	25	30
Flour	Kg	25	10	12
Cloth	Metre	12	40	60
Tea	Kg	1	150	200
Vegetable ghee	Kg	5	50	60
Eggs	Dozen	4	25	30

(05)

- Q.6(a) What will be value of Standard Error if all the observed values fall on regression line $\hat{y} = 2x + 8.25$ and $\sigma_y = 12$ (01)
- (b) While estimating the values of y through a regression line of Y on X , we find that
 at $x = 0$; $y = 8.25$
 and at $x = 3$; $y = 12$
 Find the value of :
- (i) a (y intercept) (01)
 (ii) b_{yx} (Regression co-efficient) (01)
 (iii) What does b_{yx} represent (01)
- (c) In Q.6 (b) find the value of $\sum Y$ if $\sum X = 80$ and $n = 10$ (03)
- (d) Compute co-efficient of co-relation r if $b_{yx} = 9.5$ and $b_{xy} = 0.09$ (02)
- (e) What is the relationship between r_{xy} and r_{yx} (01)
- (f) Draw a Scatter Diagram showing negative and linear relationship (02)
- Q.7(a) A class contains 10 boys and 20 girls of which half the boys and half the girls have brown eyes. Find the probability that a person selected at random is a boy or has brown eyes. (02)
- (b) Of the bolts produced by a factory, 2% are defective. In a shipment of 3600 bolts from the factory, find the expected number of defective bolts and the standard deviation. (03)
- (c) A section of a tunnel is lit by 2000 electric bulbs which are kept burning day and night. The manufacturer says that the lives of the bulbs are normally distributed about a mean of 820 hours with standard deviation of 90 hours. How many electric bulbs will be expected to fail before 1000 hours? (03)
- (d) Among a department's 16 trucks, 5 emit excessive amount of smoke. If eight of the trucks are randomly selected for inspection, what is the probability that this sample will include at least 4 of the trucks which emit excessive amount of smoke? (04)
- Q.8(a) In estimating population means from sample a 99% assurance is required that sample mean is not different from population mean by more than half of standard deviation. What should be the minimum size of the sample $Z_{\alpha/2} = 2.58$ (03)
- (b) The test scores of students of Zone A and Zone B yielded the following results
- | | Sample size | Mean Score | Sample Std Dev |
|--------|-------------|------------|----------------|
| Zone A | 150 | 47.3 | 7.3 |
| Zone B | 100 | 45.4 | 6.9 |
- If population scores are normal test the hypothesis that there is no difference between mean scores at a significance level of $\alpha = 0.05$ (05)
- (c) A large normally distributed population has a mean of 1.14 and standard deviation of 0.25. A sample of size 100 is selected. What is the probability that sample mean is greater than 1.16 (03)

(THE END)