

2018

DDE

M.Com.

Part-I Examination

**QUANTITATIVE TECHNIQUES FOR
MANAGERIAL DECISIONS**

PAPER—II

Full Marks : 100

Time : 4 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Write the answer to question of each Half in separate books.

First Half

(Business Statistics)

[Marks : 50]

Answer Q. No. 1 and any two from the rest.

1. Answer any four questions : 4x5

(a) Given the following equation $y = 84.26 + 5.8 t$

(Origin : 2017, t unit = 1 year)

(Turn Over)

Change the origin (i) to 2014 and (ii) to 1st January, 2018. 2+3

(b) (i) Show that Laspey's Price Index is the weighted Arithmetic Mean of Price Relative, where weight is the base year value.

(ii) Show that Pasche's Price Index is the weighted Harmonic Mean of Price Relative, where weight is the current year value. 2+3

(c) A survey was conducted in respect of marital status and success in Examination. Out of 2000 persons who appeared for an examination, 80% of them were boys and the rest were girls. Among 300 married boys, 140 were successful, 1100 boys were successful among unmarried boys. In respect of 100 married girls 40 were successful, 200 unmarried girls were successful. Construct to separate nine-square tables and find out the Yule's co-efficient of Association to discuss the association between marital status and passing of examination. $2\frac{1}{2}+2\frac{1}{2}$.

(d) What is Interpolation? Distinguish between Interpolation and Extrapolation. What is Inverse Interpolation. 1+2+2

(e) Distinguish between partial correlation and multiple correlation.

(f) Show that for linear regression of y on x , the coefficient of determination—

$$r_{xy}^2 = \frac{\text{Explained variation in } y}{\text{Total variation in } y}$$

(g) What is statistical quality control. Distinguish between the chance causes and assignable causes for variation in produce quality.

(h) A machine is set to deliver packets of a given weight. 10 samples of size 5 each were recorded. The sample data are given below:

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean (\bar{x})	15	17	15	18	17	14	18	15	17	16
Range (R)	7	7	4	9	8	7	12	4	11	5

Construct a mean chart by calculating the values of CL, UCL, and LCL [Given : $A_2 = 0.577$ for $n = 5$; $A_2 = 0.308$ for $n = 10$]

2. (a) In calculating cost of living index number, the weight used were : Food 8.5, Rent 2, Clothing 3.5, Fuel and Light 1, and Miscellaneous 2. Calculate the cost of living index number where the percentage increase in the prices of the various items in 2018 over 2015 were for food 40, for rent 75, for clothing 60, for fuel and light 35 and for miscellaneous 80 respectively.

(b) Show that Fisher Price Index formula satisfies the Factor Reversal test.

- (c) From the following data calculate Fisher's Price Index Number of four commodities.

Commodity	Base Year		Current Year	
	Price per Unit (₹)	Expenditure (₹)	Price per unit (₹)	Expenditure (₹)
A	2	40	5	75
B	4	16	8	40
C	1	10	2	24
D	5	25	10	60

5+5+5

3. (a) Fit a Parabolic trend to the following time series data and estimate the production in 2020 :

Year	2011	2012	2013	2014	2015	2016	2017
Production (in '000 units)	42	49	62	75	92	122	158

- (b) A company estimates its sales for 2020 to be ₹36,00,000. The seasonal indices for sales are as follows :

Month	Seasonal Index	Month	Seasonal Index
January	75	July	103
February	80	August	106
March	98	September	110
April	128	October	105
May	137	November	85
June	119	December	75

(8+2)+5

4. (a) Interpolate the missing item in the following series:

Year	2012	2013	2014	2015	2016	2017
Population (in Lakhs)	173	149	145	?	131	141

- (b) Determine the percentage of criminals under 35 years of age.

Age	Percentage of Criminals
Under 25 years	52.0
Under 30 years	67.3
Under 40 years	84.1
Under 50 years	96.4

- (c) Write notes of Difference Table prepared in interpolation. 5+7+3

5. (a) What is linear regression ? State the important properties of linear regression.

- (b) Given the following results for the heights (y) and weights (x) of 1,000 students :

$$(\bar{y}) = 68 \text{ inches, } \bar{x} = 150 \text{ lbs}$$

$$S_y = 25 \text{ inches, } S_x = 20 \text{ lbs}$$

$$r_{xy} = 0.69$$

Titu weights 200 lbs and Tomu is 65 inches tall. Estimate Titu's height and Tomu's weight.

- (c) In an interview eight candidates have been ranked by two experts as follows :

Candidates:	A	B	C	D	E	F	G	H
Expert I:	2	4	6	5	3	1	8	7
Expert II:	1	3	6	4	2	5	7	8

Calculate Kendall's tau to estimate the value of rank correlation coefficient. 4+6+5

Second Half

(Quantitative Techniques for Managerial Decisions)

[Marks : 50]

Answer Q. No. 6 and any two from the rest.

6. Answer any four questions : 4×5

- (a) A company has four factories F_1, F_2, F_3 and F_4 , from which ships its product units to four warehouses W_1, W_2, W_3 and W_4 which are the distribution centres. Transportation cost per unit between various combination of factories and warehouses are as given below : 5

Warehouse → Factory ↓	W_1	W_2	W_3	W_4	Available units
F_1	48	60	56	58	140
F_2	45	55	53	60	260
F_3	50	65	60	62	360
F_4	52	64	55	61	220
Requirement	200	320		210	

Find the Initial Feasible solution using VAM. 5

(b) Write notes on the steps to solve a maximisation assignment problem. 5

(c) Find the dual of the following primal L.P.P.

$$\text{Max } z = 2x_1 + x_2 + x_3$$

Subject to,

$$4x_1 + 3x_2 + 3x_3 = 6$$

$$x_1 + 2x_2 + 5x_3 = 4$$

Provided that $x_1, x_2, x_3 \geq 0$.

(d) Describe the importance of operations research in management decisions.

(e) Explain the significance of lead time and safety stock in inventory control. 2+2+1

(f) Draw a network from the following activity and find a critical path and duration of a project.

Activity	Immediate Predecessors	Duration (days)
A	—	3
B	—	8
C	A, B	4

D	B	2
E	A	1
F	C	7
G	E,F	5
H	D,F	6
I	G,H	8
J	I	9

(g) An AC serviceman finds that the time spent on his job has an exponential distribution with mean 20 minutes. If he repairs set in the order in which they come in and if the arrival of sets is approximately Poisson with an average rate of 8 per 8 hours a day, what is the serviceman's expected idle time each day? How many jobs are on an average in the system?

(h) Explain the following terms in the context of network analysis : 5

(i) Total Float ;

(ii) Free Float ;

(iii) Independent Float ;

(iv) Interfering float ; and

(v) Dummy Activity.

7. Five different machines can do any of the five required jobs, with different profits resulting from each assignment as shown in the adjoining Table. Find out maximum profit possible through optimal assignment.

Job	Machine→				
	A	B	C	D	E
↓					
1	30	37	40	28	40
2	40	24	27	21	30
3	40	32	33	30	35
4	25	38	40	36	36
5	29	62	41	24	39

(b) Write notes on (MODI) Modified Distribution method in optimal solution in transportation problem. 10+5

8. (a) Solve the following Linear Programming Problem (LPP) using Simplex method

$$\text{Max } z = 3x_1 + 9x_2$$

$$\text{Subject to, } x_1 + 4x_2 \leq 8;$$

$$x_1 + 2x_2 \leq 4;$$

$$\text{Provided that } x_1, x_2 \geq 0. \quad 10$$

(b) Write a note on 'Degeneracy' in a LPP. 5

9. (a) A Manufacturing company purchases 9,000 parts of a machine for its annual requirements, ordering one month's requirement at a time. Each part costs ₹ 20. The ordering cost per order is ₹15 and the carrying charges are 15 per cent of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice you offer and how much would it save the company per year?

- (b) The annual demand for a product is 500 units. The cost of storage per unit per year is 10% of the unit cost. The ordering cost is ₹ 180 for each order. The unit cost depends upon the amount ordered. The range of amount ordered and the unit cost price are as follows :

Quantity	Price
$0 \leq q_1 < 500$	₹25
$500 \leq q_2 < 1,500$	₹24.80
$1,500 \leq q_3 < 3,000$	₹24.60
$3,000 \leq q_4$	₹24.40

Find the optimal order quantity.

5+10

10. The required data for a small project consisting of different activities are given below :

Activity	Dependence	Normal duration (days)	Normal cost (₹)	Crash duration (days)	Crash cost (₹)
A	—	6	300	5	300
B	—	8	400	6	600
C	A	7	400	5	600
D	B	12	1000	4	1400
E	C	8	800	8	800
F	D	7	400	6	500
G	D,F	5	1000	3	1400
H	F	8	500	5	700

- (i) Draw the network and find out the usual project length and minimum project length.
- (ii) If the project is to be completed in 21 days with minimum crash cost, which activities should be crashed by how many days ?

8+7