Class   : I M.Com
Subject   : **Quantitative techniques for decision making**
Subject Code   : **P16MC22**

PART -A

Unit – I

1. Explain the role of quantitative techniques

2. What are the components of Time series?

3. Mention any two advantages of quantitative techniques

4. Define correlation.

5. Define time series. Explain the methods in time series.

6. What is the formula for R 1.23?

7. Define quantitative techniques

8. What is the necessity of operating research in industry?

9. What is regression coefficient?

Unit – II

1. The mean and variance of binomial distribution are…………………….. and
   ……………

2. State multiplication theorem of probability

3. State the terms of procedures for calculating probability.

4. Explain the importance of Binomial distribution

5. What is trial?

6. Write an note on random experiment?

7. What is expected opportunity laws?

8. Four coins are tossed. Find the probability of getting two heads and two tails.

9. Define multiplication theorem of probability.

10. Define addition theorem of probability.

11. State any two applications of Poisson distribution.

12. What is a random variable?

13. List the proprieties of binomial distribution.

14. Suppose a manufactured product found to contain 2 defective on inspection. By using poission distribution find the probability of getting no defective, one defective, two defective and three defective.

Unit – III

1. What do you mean by level of significance?

2. Mention any two applications of 't' test.

3. What are the procedures of testing hypothesis.

4. State the formula for testing difference between means of two samples.

5. What is meant by descriptive hypothesis?

6. What is a hypothesis?

7. List any two assumptions of variance analysis.

8. What is mean by null hypothesis?

9. List out any four constant of X2 distribution and its formulae.

10. Define a sampling distribution

11. What is meant by alternative hypothesis.

12. What is type two error?

13. What are the types of hypothesis?

14. When will you go for ANOVA?

Unit – IV

1. What is a balanced transportation problem?

2. What is an assignment problem?

3. Write any two application of transportation mode

4. What is a branch and bound method?

5. What are the advantages of LPP?

6. What are the conditions for applications for simplex method?

7. What is a degenerated solutions?

8. When degeneracy occurs in transportation problem?

9. How the unbalanced assignment problem, will be converted into balanced assignment problem?

10. Define slack variables

11. What are the two types of basic feasible solution?

12. What is an initial basic feasible solution?

13. What is the optimality condition for transportation problem?

14. What is the optimality condition for an LPP?

15. What is meant by optimum basic feasible solution?

16. What is assignment model?

17. Define "dual" of an LPP.

18. What is meant by purposive sampling?

19. Analyze the term transportation problem.

20. State any two application of linear programming.

21. Define the terms degeneracy and balanced condition.

22. What is meant by constraints?

23. Define the term "feasible solution" and " optimal solution".

24. What is LP formulation?

25. What is meant by simplex method?

Unit – V

1. Define interpolation.

2. What is binomial expansion method?

3. What do you mean by vital statistics?

4. What is crude death rate?

5. What is standardized death rate?

6. What is life table?

7. What is vital index?

8. What is long range method?

9. What do you mean by parabolic curve method?

10. Write a formula in Newton's dividend method.

11. What is extrapolation?

PART -B

Unit – I

1. Explain the application of operation research in business.

2. What is a quantitative technique? Explain its pro's and con's in business decision.

3. Explain the applications of quantitative technique in detail

4. What are the properties of regression coefficient?

5. Calculate correlation co – efficient from the following data:

   X: 100 200   300   400   500   600   700

   Y : 30 50   60   80   100   110   130

6. fit a straight line trend by least square method to the following data and also estimate the value for 2005:

Years	:	1970	1975	1980	1985	1990	1995	2000
Production (in 000 units)	:	6	8	9	10	12	11	8

7. $\sum^1 XY = 283.84, \sum^1 X^2 = 152.48$ and $\sum^1 Y^2 = 617.56$. Find correlation coefficient.

8. Given the following data. Find the regression- equation of Y on X.

   X: 6   2   10   4   8

   Y :   9   11   5   8   7

9. Calculate co – efficient of correlation for the following

X:	10	6	9	10	12	13	11	9
Y:	9	4	6	9	11	13	8	4

10. Compute the co-efficient of correlation between X and Y

X:	10	12	18	8	13	20	22	15	5	17
Y:	88	90	94	86	87	92	96	94	88	85

11. Fit a trend line for the following data by the free – hand method.

Year :	2000	2001	2002	2003	2004	2005	2006
Sales in units (in thousand) :	65	95	85	115	110	120	130

12. The following zero order correlation coefficient is given.

$r_{12} = 0.98$, $r_{13} = 0.44$ and $r_{23} = 0.54$.

Calculate multiple correlation co-efficient treating first variable as dependent and second and third variable as independent.

13. In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible.

Variance of X = 9

Regression equations:

$8X – 10 Y = -66$

$40 X – 18 Y = 214$

Calculate:

   i.   Co-efficient of correlation between X and Y and

   ii.   Standard deviation of Y.

14. The seasonal indices of the sale of readymade garments in a store are given below:

Quarter	Seasonal index
January to March	98
April to June	90
July to September	82
October to December	130

If the total sales of garments in the first quarter in worth Rs.1,00,000, determine how much worth garments of this should be kept in stock to meet the demand in each of the remaining quarters.

15. In a bivariate distribution having 10 pairs of observation, they following values were obtained

$\Sigma dx = -4$; $\Sigma d2x = 1,28,912$; $\Sigma dy = -5$; $\Sigma d2y = 3091$; $\Sigma dxdy = +15582$

Unit – II

1. What is the probability that a non leap year selected at random has fifty Sundays?
2. State and prove addition theorem of probability.
3. Ten coins are thrown simultaneously. Find the probability getting at least seven heads.
4. A Bag contains 5 white and 4 black balls. One ball is drawn from the bag and replace and then a second drawn of a ball is made what is the chance that the two balls draw are of different colours.
5. A mean yield per plot of a crop is 17 kg and standard deviation is 3 kg of distribution of yield per plot is normal, find the % of plots giving yields between 15.5 kg and 20kg.
6. Calculate the probability of picking a card that was a heart or a spade.
7. A coin is tossed six times. What is the probability four or more heads.
8. A box contain 3 red and 7 white balls. One ball is drawn at random and in its place, a ball of the other colour in put in the box. Now one ball in drawn at random from the box. Find the probability that it in red?
9. The probability that an evening college student will graduate is 0.4. Determine the probability that out of 5 student i) none ii) one and iii) at least one will be graduate.
10. From a pack of well shuffled playing cards, one card is drawn at random. Find the probability that it is
    i. An ace
    ii. A spades
    iii. A clubs
    iv. A spades or a clubs
    v. An ace or a spades
11. In hospital, 480n female and 520 male babies were born in a week. Do these confirm the hypothesis that males and females are born in equal number?
12. 160 heads and 240 tails were obtained in tossing a coin 400 times. Find a 95 per cent confidence interval from the probability of a head.
13. A machine turnsout16 defective items in a batch of 500. After overhauling, it turnout 3 defective items in a batch of 100. Has the machine improved after overhauling?
14. If an average 8 ships out of 10 arrive safely to ports. Obtain mean and standard deviation f ships returning safely of out of a total of 150 ships.
15. Determine the binomial distribution for which is the mean is 4 and variance 3. Also find $P(x = 15)$
16. Find the probability that atmost five defective fuses will be found in a box of 200 fuses it experience shows that 2% of such fuses are defective, given that e-4 = 0.0183.
17. A bag contains 6 white and 4 black balls. Two balls are drawn at random one after another without replacement. Find the probability that both drawn balls are white.
18. Out of every 1000 investors 20 complaint non – receipt of share certificates and 18 have their names wrongly spelled of these, 5 have both these complaints. What is the probability of any randomly chosen investor are any complaint?

Unit – III

1. What is the role of hypothesis?

2. Briefly describe the procedure of testing a hypothesis.
3. Define hypothesis and explain its types.
4. In a sample of 8 observations, the sum of issued deviations of items from the mean was 84.4. In another sample of 10 observations, the value was found to be 102.6. test where the differences in variance is significant ($v_1 = 8, v_2 = 10$ d.f value is 3.07; $v_1 = 7$, $v_2 = 9$ d.f the value is 3.29)
5. What are Type I and Type II errors in tests of hypothesis. How is a test of hypothesis constructed?
6. The following table gives the classification of 100 workers according to sex and the nature of work. Test whether nature of work is independent of the sex of the worker.

	Skilled	Unskilled
Male	40	20
Female	10	30

7. The mean weekly sales of soap bars in departmental stores was 146.3 bars per store after an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and S.D sis 17.2 was the advertising campaign successful ($t_{21, 0.05} = 1.72$)
8. The following are the sales figures of two salesmen of a certain product. Salesmen A claims that his sales performance in better than that of B. test his claim using t-statistics given the t- value from the table as 2.26 at a, d.f at 5% L.O.S.

	A	B
No. of sales	5	6
Average size	1000	2000
SD	60	70

9. Write down the value of r if

x:	1	2	3	4	5
y:	3	6	9	12	15

10. The following table gives age(x) in years of cars and annual maintenance cost (y) (in hundred rupees)

x:	1	3	5	7	9
y:	15	18	21	23	22

Estimate the maintenance cost for a 4 years old car after finding the regression equation.

11. A company is testing two machines. A random sample of 8 employees in selected and each employee uses each machine for one hour. The number of components produced is shown in the following table:

Employee :	1	2	3	4	5	6	7	8
I Machine	96	107	84	99	102	87	93	101
II Machine	99	112	90	97	108	97	94	98

Test whether there is evidence of difference between the machines in the mean of components produced. (Table value of t for 7df at 5% level = 2.365)

12. In 120 throws of a single die, the following distribution of faces was observed:

Face:	1	2	3	4	5	6
Frequency:	30	25	18	10	22	15

Can you say that the die is biased? (Table value of x^2 for 5df = 11.07)

13. 1600 families were selected at random in a city to test the believe that high income families usually send their children to public schools and low income families often send their children to government schools. The following results were obtained

Income	School		Total
	Public	Government	
Low	494	506	1000
High	162	438	600
Total	656	944	1600

Test whether Income and Type of school are Independent

Unit – IV

1. Write the algorithm of simplex method to solve LPP
2. Describe Vogel's approximation method for transportation problem.
3. What is an unbalanced assignment problem? How is it solved for an optimal solution?
4. Explain the steps for graphical solution for LPP.
5. Describe the simple method of solving linear programming problem.
6. Explain the terms a) slack variables b) surplus variables
7. Obtain initial basic feasible solution by north west corner rule

To \ From	D	E	F	Supply
A	6	4	1	50
B	3	8	7	40
C	4	4	2	60
	20	95	35	150

8. Solve the following using least cost method:

	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Demand	6	10	15	14	35

9. Max z $= x_1 + x_2$

Subject to constraints:

$X_1 + X_2 \leq 1$

$-3X_1 + X_2 \geq 3$

$X_1, X_2 \geq 0$

Solve the above LPP by graphical method.

10. Solve the assignment problem

	A	B	C	D

I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

11. Determine an IBFS to the following transportation problem using NWCR.

	D1	D2	D3	D4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Required	6	10	15	4	35

12. Solve the following Assignment problem

Machine

Jobs	M_1	M_2	M_3	M_4
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

13. A paper mill produces two grades of paper namely X and Y. Because of raw material restrictions, it cannot produce more than 400 tons of grade X and 300 tons of grade y in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce a ton of products X and Y respectively with corresponding profits of Rs.200 and Rs. 500 per ton. Formulate the above as a LPP to maximize profit.

14. Solve the following LPP graphically

Max $Z = 8x_1 + 5x_2$

$2x_1 + 2x_2 \leq 500$

$x_1 \geq 150$

$x_2 \geq 250$

and $x_1, x_2 \geq 0$

15. Obtain IBFS by north west corner rule

	D1	D2	D3	supply
O1	2	7	4	5
O2	3	3	1	8
O3	5	4	7	7
O4	1	6	2	14
Demand	7	9	18	

16. Solve the transportation problem for minimization

	D1	D2	D3	Capacity
O1	2	2	3	10
O2	4	1	2	15
O3	1	3	1	40
Demand	20	15	30	65

17. Max $Z = 3X_1 + 9X_2$

Subject to constraints $X_1 + X_2 \leq 8$; $X_1 + 2X_2 \leq 4$

$X_1, X_2 \geq 0$. Solve the above LPP by graphical method

18. Solve the following using transportation problem

	S1	S2	S3	S4	Supply
A	5	2	4	3	22
B	4	8	1	6	15
C	4	6	7	5	8
Demand	7	12	7	19	45

19. A company has 5 machines and 5 jobs to be done. the return in Rs, of assigning i^{th}

machines to the jth job.

$i,j = 1,2,3,4,5$ is as follows

Assign the jobs to the 5 machines so as to maximum the total profit.

Machine	Job				
	1	2	3	4	5
A	5	11	10	12	4
B	2	4	6	3	5
C	3	12	5	14	6
D	6	14	4	11	7
E	7	9	8	12	5

20. Solve the LPP using Simplex method

Maximize $Z = x_1 + 4x_2 + 5x_3$

Subject to constraint

$3X_1 + 3X_2 \leq 22$

$X_1 + 2X_2 + 3X_3 \leq 14$

$3x_1 + 2X_2 \leq 14$ and

$X_1, X_2, X_3 \geq 0$

21. Obtain an initial basic feasible solution to the following transportation problem.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	

22. The cost matrix for each job ,machine combination is as follows

Job	Machine X	Machine Y	Machine Z
A	30	30	25
B	45	18	25
C	21	17	15

Find the optimum assignment of jobs to machines.

23. A dealer manufactures only two items: Ceiling fans and table fans. He has Rs. 9,000 to invest and a space to store at most 75 pieces. A ceiling fan costs is Rs. 300 and a table fan Rs. 150. He expects to gain Rs. 50on a ceiling fan and Rs. 20 on a table fan. Assuming that he can sell all the fans that he manufactures. Formulate the above problem as an LP model.

24. Two random samples gave the following results.

$\eta_1 = 10, \Sigma(x_1 - \overline{x})^2 = 90$

$\eta_2 = 12, \Sigma(y_1 - \overline{y})^2 = 108$

Test whether the samples came from the populations with the same variance.

25. Mark the feasible regions represented by constraint in equations

$x_1 + 3x_2 \leq 1$

$3x_1 + x_2 \geq 3$

$x_1 + x_2 \leq 0$

of a linear optimizing function $z = x_1 + x_2$

26. A company has two grades of inspectors 1 and 2 undertake quality control inspection. At least 4,500 pieces must be inspected in an 8 hour day. Grade 1 inspector can check 30 pieces in an hour with an accuracy of 95%. Grade 2 inspector cheeks 25 pieces an hour with an accuracy of 90%. The daily wages of grade 1 inspector are Rs.12 per hour while those of grade 2 inspector are Rs.8 per hour. Any error made by an inspector costs Rs.6 to the company. If there are, in all, 30 grade 1 inspectors and 35 grade 2 inspectors in the company, find the optimal assignment of inspectors that minimizes the daily inspection cost.

Formulate the LPP mathematically.

27. Given a normal curve with $\mu = 25.3$ and $\sigma = 8.1$, find the area under the curve between 20.6 and 29.1

28. Solve the following problem using graphical method:

Maximize $z = 21x_1 + 15x_2$

$-x_1 - 2x_2 \geq -6$

$4x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$

29. A person requires at least 10,12 and 12 units 2 chemical A,B,C respectively for his garden. A liquid product contains 5,2 and 1 units of A,B, and C respectively per jar, a dry product contains 1,2,and4 units of A,B,C per carton. The liquid product sells for Rs.3 per jar and dry product sells for Rs.2 per carton. Formulate the above problem.

30. Solve the following transportation problem:

	A	B	C	a_i
F1	10	9	8	7
F2	10	7	10	8
F3	11	9	7	5
bj	9	8	3	20

31. Find the optimal solution for the assignment problem with to following cost matrix:

		Area		
		X	Y	Z
Salesman	A	11	17	8
	B	9	7	12
	C	13	16	15

32. Jim Jones produces inexpensive furniture to students. Currently it produces book cases and tables. Each book case gives a yield of Rs.60 and each table Rs.50. each product has to pass through two stages of production, namely cutting and finishing. Book cases take four hours a unit in cutting and four hours in finishing. Tables take respectively three hours and five hours. Currently they are available in cutting and 120 hours in finishing in the factor in the week. Formulate the problem as LPP model.

33. A construction has three projects A,B and C. Truck load of sands required per week for the three projects are : 80,100 and 120. Three supply points are there namely, X,Y and Z with a capacity per the week of 120,80 and 100 loads respectively. The delivery cost per load from each supply sites to each demand point are as follows:

	Cost per load		
	To A	To B	To C
From X	12	8	18
From Y	17	10	12
From Z	19	5	8

Decide how many trucks loads of sand from the supply points to the different projects inorder to reduce transportation cost.

Unit – V

1. What are the significance of interpolation and extrapolation?
2. Explain the assumptions of interpolation and extrapolation?
3. What are the uses of vital statistics?
4. How do you measure the fertility rate?
5. What are the uses of life table?
6. Estimate the production for the years 2011 and 2013 with the help of the following table

Year	2008	2009	2010	2011	2012	2013	2014
Production:	200	220	260	?	350	?	430

(in "000 ton)

7. Extrapolate the business done in 2015 from the following data:

Year	2010	2011	2012	2013	2014

Business done :   150   235   365   525   780

(Rs. Lakhs)

8. Compute the crude and standardized death rates of the two populations A and B from the following data

Age group(years)	A		B	
	Population	Death	Population	Deaths
Below 5	15,000	360	40,000	1,000
5 – 30	20,000	400	52,000	1,40
Above	10,000	280	8,000	240
Total	45,000	1,040	1,00,000	2,280

9. Compute general fertility rate and gross reproduction rate from the data given below:

Age group of child :   15 – 19 20 – 24 25 – 29 30 – 34 35 – 39 40 – 44 45 - 49

Bearing females

No of women ('000):   16.0   16.4   15.8   15.2   14.8   15.0   14.5

Total birth: 260   2244   1894 1320   916   280   145

10. Fill the blanks in the following skeleton life table which are marked with question marks(?) and explain the meaning of the symbols at the head of the columns

Age	l_x	d_x	q_x	p_x	L_x	T_x	O_x
20	693435	?	?	?	?	35081126	?
21	690673	-	-	-	-	-	-

PART - C

Unit – I

1. From the following data, calculate the co – efficient of correlation between age of students and their playing habit

Age	14	15	16	17	18
No of students	300	200	150	120	100
Regular players	225	130	0	48	35

2. Obtain the rank correlation co – efficient for the following data:

X :   68   75   50   64   80   75   40   55   64

Y :   58   68   45   81   60   68   48   50   70

3. Fit a straight line trend by the method of least squares

Year: 1989 1990 1991 1992 1993 1994 1995 1996

Earnings: 38 40 65 72 69 60 87 95

Estimate the trend value for the year 1998

4. Obtain the regression line of X on Y from the following data.

   X: 65 66 67 67 68 69 70 72

   Y: 67 68 65 68 72 72 69 71

5. Number of Pairs of observation of X and Y series = 8

X series Arithmetic mean	= 74.50
X series Assumed mean	= 69.00
X series Standard Deviation	= 13.07
Y series Arithmetic mean	= 125.50
Y series Assumed mean	= 112.00
Y series Standard Deviation	= 15.85

   Summation of products of corresponding deviation of X and Y series = 2176

   Calculate the coefficient of correlation between X and Y series

6. In a trivariate distribution, it is sound that $r_{12}=0.7$, $r_{13}=0.61$, $r_{23}=0.4$

   Find the value of $r_{23.1}$, $r_{13.2}$ and $r_{12.3}$

7. In a bivariate distribution $\sigma_1 = 3$, $\sigma_2=4$, $\sigma_3=5$, $r12 = 0.7$, $r13=0.61$, $r23=0.4$. Find the partial and multiple correlation co – efficient.

8. From the following data find the two regression co – efficient. Also calculate the value of r and verify by actual calculations:

Y \ X	1	2	3	4
10	3	2	….	….
20	2	3	1	…
30	…	1	1	3
40	….	….	3	1

Unit – II

1. State and prove multiplication theorem of probability

2. If the letter of the word 'SUCCESS' are arranged at random, what is the probability that there are exactly two letters between U and E?

3. A bag contains 10 red, 5 white and 4 blue balls. If 4 balls are drawn at random. Determine the probability that

   a) All 4 are blue balls and

   b) 1 Red and 2 are white

4. Fit a Poisson distribution:

   No of mistakes per page: 0 1 2 3 4 5

No of pages: 142   156   69   27   5   1

5. Find the Poisson distribution to the following data

No. of mistakes per page :	0	1	2	3	4
No. of pages :	109	65	22	3	1

6. Eight coins are tossed at a time 256 times. Number of head observed at each throw is recorded and the results are given below: find the expected frequencies. What are the theoretical values of mean and standard deviation? Calculate also the mean and standard deviation of the observed frequencies:

No of heads at a throw	0	1	2	3	4	5	6	7	8
Frequency		2	6	30	52	67	56	32	10	1

Unit – III

1. What is the meaning of analysis of variance? Explain the techniques of analysis of variance for data with one way classification.

2. Test whether the samples come from normal population. (use t test $t_{0.05}, 20 = 2.086$)

Sample	Size	Mean	$(x-\bar{x})^2$
1	10	15	90
2	12	14	108

3. In an experiment on immunization of cattle from tuberculosis, the following results were obtained:

	Affected	Not affected
Inoculated	12	26
Non inoculated	16	6

Calculate χ^2 (chi – square $\chi^2_{0.05}(1) = 3.84$)

4. The following figures show the distribution of digits in number chosen at random from a telephone directory

Digits :	0	1	2	3	4	5	6	7	8	9
Frequency:	1026	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be takes to occur equally frequently in directory ($x^2_{0.05}$ for 9 d.f = 16.9)

5. A marketing agency gives following information about the age groups of the sample informants and their liking for a particular model of scooter which a company plans to introduce.

Age group of informants

	Below 20	20 – 29	40 – 59	Total
Liked	125	420	60	605
Disliked	75	220	100	395

Total	200	640	160	1000

On the basis of the above data, can it be concluded that the model appeal is independent of the age of the informants?

6. Four sales man were posted in different areas by a company. The number of units of commodity X sold by them are us follows

A	20	23	28	29
B	25	32	30	21
C	23	28	35	18
D	15	21	19	25

On the basis of this information, can it be concluded that there is a significance difference in the performance in the four salesmen? (given for $V1 = 3$ and $V2 = 12$, $f0.05 = 3.24$)

7. 1000 students at college were graded according to their IQ and the economic conditions of their home x2 test to find out whether there is any association between economic condition and IQ

Economic conditions	IQ		Total
	High	Low	
Rich	460	140	600
Poor	240	160	400
Total	700	300	1000

Given for $V = 1, \chi2_{0.05} = 3.84$

8. The number of male and female birth in 1000 families having the children:

Male children	0	1	2	3	4	5
Female children	5	4	3	2	1	0
No of families	40	300	250	200	130	80

Test whether the given data is consistent with the hypothesis that the binomial law holds with even chance of getting a male or female child.

(Table value at 5% 11.07)

Unit – IV

1. Explain computational procedure simplex method to solve an LPP

2. How should the jobs be allocates from the following matrix so as to minimize the total man – hour?

Employees

		I	II	III	IV	V
	A	10	5	13	15	16
	B	3	9	18	13	6
Jobs	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	0	4	12

3. Solve the following transportation problem using VAM and test for optimality

Destination

Sources

	1	2	3	Capacity
1	2	2	3	10
2	4	1	2	15
3	1	3	1	40

Demand   20   15   30

4. Solve the LPP using Simplex method

Maximize $Z = 6x_1 - 3x_2 + 2x_3$

Subject to constraint $2x_1 + x_2 + X_3 \leq 16$,

$3X_1 + 2X_2 + 3X_3 \leq 18$,

$X_2 - 2X_3 \geq 8$ and

$X_1, X_2, X_3 \geq 0$

5. Solve the following transportation problem using VAM

	D1	D2	D3	D4	supply
O1	2	2	2	1	3
O2	10	8	5	4	7
O3	7	6	6	8	5
Demand	4	3	4	4	15

6. Use simplex method to solve the LPP

Max Z = $3x_1 + 2x_2$

Subject to:

$x_1 + x_2 \le 4$

$x_1 - x_2 \le 2$

and $x_1, x_2 \ge 0$

7. From the following matrix determine the minimum total man hours and find how should the policy be allocated.

	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

8. A manufacturing company is engaged in producing b types of products A,B,C. The production department produces each day, components sufficient to make 50 units of A, 25 units of B and 30 units of C. only 100 man hours are available daily for assembling for products. a additional information are

Type	profit/ unit(Rs)	assembly time/products(hrs)
A	12	0.8
B	20	1.7
C	45	2.5

The company has daily order commitment for 20 units of product and a total of 15 units of products B and C. Formulate as LPP to maximize the profit.

9. Solve the following LPP, using simplex method

Max Z $= 5x_1 + 3x_2$

Subject to

$3x_1 + 5x_2 \le 15$

$5x_1 + 2x_2 \leq 10$

$x_1, x_2 \geq 0$

10. Solve the problem following transportation problem for minimum cost

Destinations	Origins				Requirement
	A	B	C	D	
1	7	4	3	4	15
2	3	2	7	5	25
3	4	4	3	7	20
4	9	7	5	3	40
Availability	12	8	35	25	100/80

11. Solve the following LPP, using simplex method

Max Z $= 5x1 + 3x2$

Subject to the constraints.

$x_1 + x_2 \leq 2$

$5x_1 + 2x_2 \leq 12$

$3x_1 + 8x_2 \leq 10$

$x_1, x_2 \geq 0$

12. The job machine cost matrix is given below:

Job	Machine X	Machine Y	Machine Z
A	25	31	35
B	15	20	24
C	22	19	17

Determine the optimum assignment

13. Solve the following transportation problem.

source	Destination				Supply
	P	Q	R	S	

A	21	16	25	13	11
B	17	18	14	23	13
C	32	17	18	41	19
Demand	6	10	12	15	43

14. Given in the table are the supply and demand factors and the transportation cost matrix. Find the optimal distribution.

Deport factory	A	B	C	D	total supply
P	4	6	8	6	700
Q	3	5	2	5	550
R	3	9	6	5	550
Total Need	400	450	350	500	1700 \ 1800

15. An engineering company produces two products A and B. the cost data are as under:

	A(Rs)	B(Rs)
Selling price	175	220
Direct materials	40	80
Direct labour	60	40
Variable overheads	30	20

Each product undergoes an operation in the two departments, viz cutting and finishing, before it emerges as a finished product. The unit time taken by the products and the maximum available hours in the cutting and finishing operations are given below

Product	cutting hours	finishing hours
A	5	10
B	20	15
Maximum hours		
Available	400	450

You are required to formulate and LP problem and solve by using simplex method to determine the number of units of A & B to be produced to maximize the contribution.

16. Consider the following transportation cost table the cost are given in Rs. The supply and demand are in units. Determine and an optimal solution

Source	Restriction					supply
	1	2	3	4	5	
I	40	36	26	38	30	160
II	38	28	34	34	198	280
III	36	38	24	28	30	240
Demand	160	160	200	120	240	

17. Solve the following LPP, using simplex method

Min $Z = 3x_1 + 2x_2$

Subject to the constraints.

$5x_1 + x_2 \geq 10$

$x_1 + x_2 \geq 6$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

18. Solve the following LPP, using simplex method

Max $Z = 45x_1 + 80x_2$

Subject to the constraints.

$5x_1 + 20x_2 \leq 400$

$10x_1 + 15x_2 \leq 450$

$x_1, x_2 \geq 0$

19. Five jobs are assigned to five persons. The time taken (in minutes) by each of them on each job is given below

Person	Jobs

	1	2	3	4	5
A	16	13	17	19	20
B	14	12	13	16	17
C	14	11	12	17	18
D	5	5	8	8	11
E	5	3	8	8	10

Work out the optimal assignment and total minimum time table.

Unit – V

1. Explain the methods of interpolation.

2. What are the methods obtaining vital statistics?

3. Explain the reproduction rates.

4. How do you measure the mortality?

5. Estimate the production for the year 1985 with the help of the following table

   Year   production (in tones)

   1960   20

   1965   22

   1970   26

   1975   30

   1980   35

   1985   ?

   1990   43

6. Give the following pairs of corresponding values of X and Y:

   X : 20 25 30 35 40

   Y : 73 198 573 1,198 1,450

7. From the following data of the wages of 500 workers of a factory find the number of

   workers:

   a) Whose wages are more than 170 but not more than 200

   b) Whose wages are less than 170 but not less than 150

     Wages not exceeding Rs.100 = 150 workers

     Wages not exceeding Rs.150 = 180 workers

Wages not exceeding Rs.200 = 240 workers

Wages not exceeding Rs.250 = 400 workers

Wages not exceeding Rs.3200 = 500 workers

8. The observed values of a function are respectively 168,120,72 and 63 at the four

positions 3,7,9 and 10 of independent variable. What best estimate can you give for

the value of the function at the position 6 of the independent variable.

9. Estimate by a suitable method of interpolation the number of persons whose daily

income is Rs.19 but does not exceed Rs.l25 from the following data:

Income (Rs)	No of persons	Income(Rs)	No of Persons
1 and not exceeding 9	50	28 and not exceeding 37	406
10 and not exceeding 19	70	37 and not exceeding 46	304
19 and not exceeding 28	203		

10. From the following data of the population of a city in lakhs, find out the population

for 1976 by the Parabolic Curve method:

Year	1961	1971	1981	1991
Population (in lakhs)	18	22	25	30

11. You are given the following information:

x: 5   6   9   11

f(x)   12   13   14   -16

Find the value of x when f(x) = 15 in Lagrange's method

12. Extrapolate the business done in 1999 from the following data:

Year	1994	1995	1996	1997	1998
Business done(Rs lakh)	150	235	335	525	780

13. Given :

$\log_{10} 654 = 2.8156$

$\log_{10} 658 = 2.8182$

$\log_{10} 659 = 2.8189$

$\log_{10} 661 = 2.8202$

Find $\log_{10} 656$ using the interpolation formula available for observations at unequal intervals say, Lagrange's formula.

14. From the following table interpolate the missing values by binomial expansion method

Years :	1991	1992	1993	1994	1995	1996	1997	1998
Value :	74	76	?	78	82	?	86	89

15. From the figures given below calculate the General Fertility Rate and the Total Fertility Rate:

Age group	: 15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of women	: 100	120	110	105	100	80	70
Specific fertility rate	: 15	100	120	140	80	50	10

(per '000)

16. From the data given below, calculate the gross and net reproduction rates:

Age group	Female production (in thousands)	Female live – births	survival factor
15-19	1,390	15,133	0.9694
20-24	1,422	94,155	0.9663
25-29	1,521	1,02,676	0.9632
30-34	1,756	72,490	0.9584
35-39	1,451	31,402	0.9519
40-44	1,689	10,640	0.9424
45-49	1,667	700	0.9279