Assignment

B.Com(Hons.) IV Semester (CBCS)
Business Mathematics (CC)
(Code : 22411402)

पूर्णांक : 100
M.M. : 100

*Attempt any **two** questions in all.*
All questions carry equal marks.

किन्हीं **दो** प्रश्नों के उत्तर दो।
सभी प्रश्नों के अंक समान हैं।

(Write your Name and Roll No. on each page of your answer sheet.)
(अपनी उत्तर पुस्तिका के प्रत्येक पृष्ठ पर अपना नाम और रोल नंबर लिखें।)

Q.1. (*a*) Mr. A went to a market to purchase 3 kg of sugar, 10 kg of wheat and 1 kg of salt. In a shop near to Mr. A's residence, these commodities are priced at Rs. 20, Rs. 10 and Rs. 8 per kg whereas in the local market these commodities are priced at Rs. 15, Rs. 8 and Rs. 6 per kg respectively. If cost of travelling to local market is Rs. 25, find the net savings of Mr. A using matrix multiplication.

(*b*) An amount of Rs 5000 is put into 3 investments at the rates of interest of 6%, 7% and 8% respectively. The total annual income is Rs. 358. If the combined income from the first two investments is Rs 70 more than the income from the third, find the amount of each investment by using matrix algebra.

(*c*) An economy produces only two commodities X and Y. The two commodities serve as intermediate input in each other's production. To produce a unit of X, 0.2 unit of X and 0.6 unit of Y are needed. Similarly, to produce a unit of Y, 0.4 unit of X and 0.3 unit of Y are needed. 30 and 50 labour hours are required to produce a unit of X and a unit of Y respectively. The wage rate is Rs. 20 per labour hour. If the final demand of X increases by 1500 units and that of Y decreases by 1200 units, find:

(*i*) Change in the gross output of each of the two commodities.

(*ii*) Change in the labour requirement.

(*iii*) Change in the value added in two producing sectors.

Q.2. (*a*) A box manufacturer makes small and large boxes from a large piece of cardboard. The large boxes require 4 sq. ft. per box, while the small boxes require 3 sq. ft. per box. The manufacturer is required to make atleast 3 large boxes and atleast twice as many small boxes as large boxes. If 60 sq. ft. of cardboard is in stock, and if the profits on the small and large boxes are Rs. 20 and Rs. 30 per box respectively, using graphic method find the number of boxes of each type that should be made in order to maximize the total profit.

(*b*) Given below is the Simplex tableau for the maximization type of linear programming problem:

Cj	**Basic Variable**	**3**	**4**	**0**	**0**	**bi**
		X_1	**X_2**	**S_1**	**S_2**	
4	**X_2**	1	1	1	0	6
0	**S_2**	1	0	-1	1	2

Answer the following questions with reasons:

(*i*) Does the tableau represent an optimal solution?

(*ii*) Are there more than one optimal solution?

(*iii*) Is this solution degenerate?

(*iv*) Is this solution feasible?

(*v*) If S_1 is slack in Machine A (in hours/week) and S_2 is slack in Machine B (in hours/week), which of these machines is being used to the full capacity when producing according to this solution?

(*vi*) A customer would like to have one unit of product X_1 and is willing to pay in excess of the normal price in order to get it. How much should the price be increased in order to ensure no reduction in profit?

(*vii*) How many units of the two products X_1 and X_2 are being produced according to this solution and what is the total profit?

(*viii*) Machine A (associated with slack S_1, in hours/week) has to be shut down for repairs for 2 hours next week. How much will the reduction in profits be?

(*ix*) What is the maximum you would be prepared to pay for another hour (per week) of capacity each on machine A and machine B?

(*c*) Explain with the help of a suitable example as to how would you find dual of a given linear programming problem.

Q.3. (*a*) The supply of a certain good is given by $x = a\sqrt{p-b}$, where x is quantity supplied, p (which is greater than b) is price and a and b are positive constants. Find the expression for the elasticity of supply as a function of price and, by using calculus, show that the elasticity decreases as price increases and becomes unity at the price equal to $2b$.

(*b*) There are 60 newly built apartments. At a rent of Rs. 4,500 per month all will be occupied. However, one apartment will be vacant for each Rs. 150 increase in rent. An occupied apartment requires Rs. 600 per month for maintenance. Find the relationship between the profit and the number of unoccupied apartments. What is the number of vacant apartments for which profit is maximum?

(*c*) The purchase price of a car is Rs. 75000. The rate of cost for repairs is given by $C = 6000(1 - e^{-0.5t})$, where t represents the years of use since purchase. Find the cumulative repair cost at the end of 5 years. Also find the equation to give the time in years at which the cumulative repair cost equals the original cost of the car.

Q.4. (*a*) Mohit deposited Rs. 1,00,000 in a bank for 3 years offering interest rate of 6% compounded half- yearly during first year, at the rate of 12% compounded quarterly during second year and at 10% compounded continuously during third year. Find his balance after 3 years.

(*b*) A machine depreciates at the rate of 8% for the first two years, at 10% for next 3 years and then at the rate of 15% per annum. Find the value of the machine at the end of 10 years, if the value of the machine is Rs. 1,00,000 initially. Find also the average rate of depreciation.

(*c*) A house is sold for Rs. 500000 down and 10 semi-annual payments of Rs. 50000 each, the first due 3 years hence. Find the cash price of the house if money is worth 20% compounded semi-annually.

(*d*) A machine costs a company Rs. 52,000 and its effective life is estimated to be 12 years. A sinking fund is created for replacing the machine by a new model at the end of its life time, when its scrap realizes a sum of Rs. 5,000 only. The price of new model is estimated to be 25% higher than the price of the present one. Find what amount should be set aside at the end of each year, out of the profits, for the sinking fund, if it accumulates at 10% effective.