The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Textile and Apparel Technology

Study Programme	: Bachelor of Industrial Studies Honours
Name of the Examination	: Final Examination
Course Code and Title	**: TAZ5544/TTZ5244-Quantitative Techniques**
Academic Year	: 2019/2020
Date	:23rd January 2021
Time	:0930-1230hrs
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of **Eight (8)** questions in Seven **(7)** pages.

3.**This question paper consists of three sections A, B, and C.**

   Answer all questions in Section A and two (02) questions each from sections B and C

4.**Total questions to be answered are five (05).Do not answer more than that.**

5. Answer for each question should commence from a new page.

6. Answers should be in clear hand writing.

7.**You should clearly show the steps involved in solving problems**

8.**No marks are awarded for the mere answers without writing the necessary steps**

SECTION A

This section carries twenty (20) marks. Answer all the questions in this section.

(01)

(i) Solve the following equations.

    (a) $2^{(3x+1)} 32^{(x+1)} = 1024$ (b) $7^{(2x+1)} + 22 = 2423$ **(02 Marks)**

(ii) Find out the gradient of the graph $Y = (2x+1)(x + 2)$, at $x=1$ **(02 Marks)**

(iii) Determine the second derivatives of the following functions with respect to x

    (a) $y = e^{8x+2}$ (b) $y = (x+3)(x + 2)$ **(04 Marks)**

(iv) Determine the stationary points of the following function and find out whether they are

    minima or maxima

    $y = x^3 - 3x^2$ **(04 Marks)**

(v)   If, $A = \begin{pmatrix} 3 & 2 \\ 4 & 1 \end{pmatrix}$ $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

    Compute $A^2 - 3A - 2I$ **(04 Marks)**

(vi) Find the determinant of the matrix A, if

$$A = \begin{pmatrix} 5 & 0 & 4 \\ 5 & 7 & 4 \\ 3 & 0 & 1 \end{pmatrix}$$ **(03 Marks)**

(vii) What do you understands by dy/dx   **(01 Marks)**

SECTION B

Maximum possible marks for this section is forty (40). Answer any two (02) questions from this section.

(02)(a)What are the parameters which characterise a straight line graph? **(02 Marks)**

(b)Manufacturing cost for an product is Rs 30,000, In addition, Rs 30 per item for packing. Manufacture get a income of Rs 500 per item and pay 10% from this to the advertising firm.

(i) Write down an expression for total cost of the Manufacture, in terms of the number of items produced (x). **(02 Marks)**

(ii)Write down the expression for the manufactures total profit in terms of number of items produced(x). (Assume that all copies are sold.) **(04 Marks)**

(iii) Plot the graph of Profit P against number of items produced (x). **(04 Marks)**

(c) Total cost of a product (P) is given by the following expression.

$$C = 400 + 4X$$; where X is the number of units produced.

(i)   Obtain an expression for average cost per product (C_{av}) **(02 Marks)**

(ii)   Plot C_{av} verses X **(06 Marks)**

(03) (a) Revenue can be expressed as a function of number of items sold (X) as follows.

R=90X -0.003 X²

The marginal revenue function is defined as $\frac{dR}{dX}$

(i) Plot the function R verses X   **(04 Marks)**

(ii) What us the meaning of the $\frac{dR}{dX}$?   **(01 Marks)**

(iii) Calculate the marginal revenue (R) at X=1000   **(03 Marks)**

(b) The total cost (C) of manufacturing X units of a product is given by the following function.

C(X) =X² -3X+4

(i) The marginal cost is defined as $\frac{dC}{dQ}$ .What is the meaning of this quantity?

(02 Marks)

(ii) Derive an expression for the marginal cost of the above product as a function of X.

(02 Marks)

(iii) Calculate the value of marginal cost at X=1000.   **(02 Marks)**

(iv) Plot the graph of marginal cost $\frac{dC}{dQ}$ with X.   **(02 Marks)**

(c)The price elasticity of demand (E) is defined as follows

$E = -\frac{dq}{dp} \cdot \frac{P}{Q}$; where P is the price and Q is the quantity demanded.

The demand function is given by Q = 300 – P²

Determine the price elasticity of demand (E),when P=10   **(04 Marks)**

(04) (a) Define following matrices of order 3x3

      (i) Unit Matrices

      (ii) Tranpose of a matrice

      (iii) Symmetric matrice   **(06 Marks)**

(b) If $A=\begin{pmatrix} 1 & 2 \\ -2 & 3 \end{pmatrix}$ $B=\begin{pmatrix} 2 & 1 \\ 2 & 3 \end{pmatrix}$ and $C=\begin{pmatrix} -3 & 1 \\ 2 & 0 \end{pmatrix}$ **(06 Marks)**

      Prove that (i) (AB) C = A (BC)

(C) If A $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$

      Show that $A^2 - 4A - 5 I = 0$ Where I is unit matrix of 3x 3

                                 (08 Marks)

(05) (a) Determine the inverse of the below given matrix.   **(10 Marks)**

$$\begin{pmatrix} 1 & -1 & 2 \\ 1 & 2 & 3 \\ 3 & -4 & -5 \end{pmatrix}$$

(b) Hence, solve following sets of equations.

      X - Y + 2Z   = 3

      X + 2Y+ 3Z   = 5

      3X - 4Y -5 Z = -13   **(10 Marks)**

SECTION C

Maximum possible marks for this section is forty (40). Answer any two (02) questions from this section.

(06)A Manufacturing company producing two products A and B during a given period of time. Each of these products require four different operations namely, C, D, E and F. The requirement in hours per unit of manufacturing of the products are given below.

Operation	Product A(hours)	Product B (hours)
C	1	2
D	3	1
E	4	3
F	5	4

Available capacities of these operations in hours for given period of time are as follows

Operation C =30 (hours)

Operation D =60 (hours)

Operation E =200 (hours)

Operation F= 200 (hours)

Profit on each unit of A is Rs 3 and Rs 2 for each of B.

Formulate the problem as linear programming model to obtain maximum profit.   **(20 marks)**

(07) The XYZ company manufactures two type of novelty souvenirs made of plywood. Souvenirs of type A requires 5 minutes each of cutting and 10 minutes each for assembling.

Souvenirs of type B require 8 minutes each for cutting and 8 minutes each for assembling.

There are 3 hrs and 20 minutes available for cutting and 4 hours for assembling.

Profit is Rs.5 each for type A and Rs. 6 for each for type B.

Formulate this problem as a liner programming model

    (a)What are the variables in this problem?   **(02 marks)**

    (b) What is the objective of this problem?   **(02 marks)**

    (c) What are the constraints of the problem?   **(04 marks)**

(d)Solve the **formatted programme graphically** to determine how many souvenirs of each type should the company be manufactured in order to get maximum profit.

(12 marks)

(08) Using the simplex method ,solve the following linear programme problem.

Maximize $Z= 4X + 5Y$

Subject to constraints $2X + 3Y \leq 12$

                $2X +Y \leq 8$

                $X \geq 0 \quad Y \geq 0$ **(20 Marks)**