THE INSTITUTE OF CHARTERED ACCOUNTANTS OF SRI LANKA

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No of Questions - 07

SCHOOL OF ACCOUNTING AND BUSINESS

BSc. (APPLIED ACCOUNTING) GENERAL / SPECIAL DEGREE PROGRAMME

YEAR I SEMESTER I (Group A)

END SEMESTER EXAMINATION – JULY 2015

QMT 10130 Business Mathematics

Date	:	15th July 2015
Time	:	9.00 a.m. - 12.00 p.m.
Duration	:	Three (03) Hours

Instructions to Candidates:

- Answer only **FIVE (05)** questions.
- The total marks for the paper is 100.
- All questions carry equal marks.
- Use of scientific calculator is allowed.
- Formula Sheet is provided.
- Answers should be written neatly and legibly.

Question No. 01

i. The elasticity of demand η is defined as $\boldsymbol{\eta = -\frac{p}{x}\frac{dx}{dp}}$

You are requested to calculate the elasticity of demand for the demand function $\boldsymbol{x = 100 - p - p^2}$ when $\boldsymbol{p = 5}$.

ii. Find the equilibrium price and equilibrium quantity for the following demand and supply functions, $\boldsymbol{q_d = 200 - 5p}$ and $\boldsymbol{q_s = 60 + 2p.}$

iii. The marginal revenue of a commodity is given by $\boldsymbol{MR = 9 - 6x^2 + 2x}$

a. Find the total revenue function.

b. Deduce the demand function.

Question No. 02

Two types of radio valves A, B are available for assembling two types of radios P and Q in a small factory. The factory uses 2 valves of type A and 3 valves of type B for a type of radio P, and for a type of radio Q it uses 3 valves of type A and 4 valves of type B. If the number of valves of type A and B used by the factory are 130 and 180 respectively.

i. Identify the unknowns to be evaluated in the above given problem.

ii. Develop the system of simultaneous equations which represent the problem.

iii. Use the matrix method to find the number of radios assembled through the solution of the system of simultaneous equation you developed in part (ii).

Question No. 03

i. Mr. A took a loan of Rs. **X** for a period of **m** years at a rate of **r** % per annum. The annual payment is calculated to be Rs. **Y**.

   a. Find a relationship among the terms **X**, **Y**, **m** and **r**.

   b. Using the results obtained in part (a) find the amount of the loan to the nearest thousand, if the annual repayment of Mr. A is Rs.5500/-, the interest charge on the loan is 12% and the loan is taken for a period of 10 years.

ii. Ms. Mary wishes to take a mortgage of Rs. 80000/- over a property for 30 years at a rate 12% per annum.

   a. Find the amount that Ms. Mary has to repay each month.

   b. After 15 years of the mortgage due to various reasons the interest rate increases to 15% per annum. Find the mortgage balance at the end of 15 years.

   c. Find the New Monthly repayment.

   d. Due to the increase in interest rate how much Ms. Mary had to pay additionally.

Question No. 04

The cost and revenue functions of a company which produces a particular heavy duty tool are given by.

$$\boldsymbol{TR = 1400\,Q - 2Q^2} \text{ and}$$
$$\boldsymbol{TC = Q^3 - 2Q^2 + 200\,Q + 1000}$$

Where $\boldsymbol{Q}$ is the number of units produced. Assume that all the units produced are sold without any restriction.

i. Find the fixed cost.

ii. Set up the profit function, π, for the given company.

iii. Find the derivative of the profit function with respect to the appropriate variable.

iv. Find the critical points of the profit function π.

v. Find the appropriate second order derivative.

vi. Find the number of units that should be produced to maximize the profits.

vii. Find the maximum profit.

Question No. 05

The demand and supply functions under pure competition are given by $\boldsymbol{p_d = 16 - q^2}$ and $\boldsymbol{p_s = 2q^2 + 4}$ respectively. Where $\boldsymbol{p}$ and $\boldsymbol{q}$ are the price and the quantity respectively.

i. Find the equilibrium quantity and the equilibrium price.

ii. Sketch the demand and the supply functions clearly stating all the required points.

iii. Highlight the consumer and producer surpluses and indicate in the sketch.

iv. Find the consumers' surplus.

v. Find the producers' surplus.

Question No. 06

A monopolist supplies his products to two markets with demand curves $\boldsymbol{P_A = 48 - 2Q_A}$ and $\boldsymbol{P_B = 60 - Q_B}$. The firm's total cost function $\boldsymbol{TC}$ is

$$\boldsymbol{TC = 15 + 10\,(Q_A + Q_B)}.$$

Show that the profit function, π, for the monopolist is given by

$$\boldsymbol{\pi = 38Q_A - 2Q_A^2 + 50\,Q_B - Q_B^2 - 15}\,.$$

Further find the number of units which maximizes his profit and the Maximum profit

Question No. 07

i. If $\boldsymbol{U(x,y,z) = 2xyz + 4xy^2 + 5xz^2 - 7x^2z}$, without using Euler's theorem prove that

$$\boldsymbol{x\frac{\partial U}{\partial x} + y\frac{\partial U}{\partial y} + z\frac{\partial U}{\partial z} = 3U}$$

ii. A company has two factories that produce T.V. sets. The two factories are located at A and B. The number of units of T.V. sets produced per month by the factory located at A is $\boldsymbol{x}$ while the number of units of T.V. sets produced per month by the factory located at B is $\boldsymbol{y}$. The joint cost function for the production of T.V. sets per month is given by

$$\boldsymbol{C(x,y) = 6x^2 + 12y^2}$$

If the company has a demand of 90 units of T.V. sets per month. Find the number of units of T.V. sets that should be produced per month by each factory to minimize the cost of production per month and find the optimal cost.

Formula Sheet

$V = P(1+r)^n$	$P_{ODI} = R\left\{\dfrac{1-(1+r)^{-n}}{r}\right\}$
$A_{ODI} = R\left\{\dfrac{(1+r)^n - 1}{r}\right\}$	$P_{PER} = R\left\{\dfrac{1}{r}\right\}$

In the following formulae a, b, c and n are real constants and u, v and w are functions of . $u = f(x)$, $v = g(x)$ and $w = h(x)$

01.	$\dfrac{d}{dx}\{cu\} = c\dfrac{d}{dx}\{u\}$	Factor Rule
02.	$\dfrac{d}{dx}\{u \pm v\} = \dfrac{d}{dx}\{u\} \pm \dfrac{d}{dx}\{v\}$	Sum Rule
03.	$\dfrac{d}{dx}\{uv\} = u\dfrac{d}{dx}\{v\} + v\dfrac{d}{dx}\{u\}$	Product Rule
04.	$\dfrac{d}{dx}\{uvw\} = uv\dfrac{d}{dx}\{w\} + u\dfrac{d}{dx}\{v\}w + \dfrac{d}{dx}\{u\}vw$	Product Rule
05.	$\dfrac{d}{dx}\left\{\dfrac{u}{v}\right\} = \dfrac{v\dfrac{d}{dx}\{u\} - u\dfrac{d}{dx}\{v\}}{v^2}$	Quotient Rule
06.	$\dfrac{d}{dx}\{u\} = \dfrac{d}{dv}\{u\}\dfrac{d}{dx}\{v\}$	Chain Rule
07.	$\dfrac{d}{dx}\{u^n\} = nu^{n-1}\dfrac{d}{dx}\{u\}$	Power Rule
08.	$\dfrac{d}{dx}\{u\} = \dfrac{1}{\dfrac{d}{du}\{x\}}$	
09.	$\dfrac{d}{dx}\{u^v\} = u^v v\dfrac{d}{dx}\{\ln u\} + u^v \ln u\dfrac{d}{dx}\{v\}$	