CHARTERED ACCOUNTANTS OF SRI LANKA

# SCHOOL OF ACCOUNTING AND BUSINESS BSc. (APPLIED ACCOUNTING) GENERAL / SPECIAL DEGREE PROGRAMME 

## YEAR I SEMESTER I (Group A) END SEMESTER EXAMINATION - FEBRUARY 2015

## QMT 10130 Business Mathematics

| Date | $:$ | $06^{\text {th }}$ February 2015 |
| :--- | :--- | :--- |
| Time | $:$ | 9.00 a.m. -12.00 p.m. |
| Duration | $:$ | Three (03) Hours |

## Instructions to Candidates:

- Answer any 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. Ranjan wants to have a total of Rs. 150000 in two years so that he can put a hot tub on his deck. He finds an account that pays 5\% annual interest compounded monthly. How much should Ranjan invest in this account so that he'll have Rs. 150000 at the end of two years?
ii. Suppose Ranjan, from our part (i), only has Rs. 130000 to invest but still wants Rs. 150000 for a hot tub. He finds a bank offering $5.25 \%$ annual interest compounded quarterly. How long will he have to leave his money in the account to have Rs. 150000 ?
iii. You have a choice from the following 2 mutually exclusive investments. If you require a $15 \%$ return,which investment should you choose?

|  | Cash Flow |  |
| :--- | :---: | :---: |
| Year | Project A | Project B |
| 0 | $(100000)$ | $(125000)$ |
| 1 | 20000 | 75000 |
| 2 | 40000 | 45000 |
| 3 | 80000 | 40000 |

## Question No. 02

A bank gives a mortgage of 450,000 dollars for 30 years with $6 \%$ annual interest. What would be the the monthly repayment figure of a person who takes the mortgage? After 10 years, if the interest rate increases to $8 \%$ per annum what would be the new monthly repayment figure?

$$
\text { Hint: } P_{O D I}=R\left\{\frac{1-(1+r)^{-n}}{r}\right\} \quad A_{O D I}=R\left\{\frac{(1+r)^{n}-1}{r}\right\}
$$

## Question No. 03

The demand and supply functions under perfect competition are given by $\boldsymbol{p}_{\mathbf{d}}=\mathbf{2 0 0}-\mathbf{q}^{\mathbf{2}}$ and $\boldsymbol{p}_{\mathbf{s}}=\mathbf{3} \boldsymbol{q}^{\mathbf{2}}+\mathbf{5 6}$ respectively. Where $\boldsymbol{p}$ and $\boldsymbol{q}$ are the price and the quantity.
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.

Hint: $\int x^{n} d x=\frac{x^{n+1}}{n+1}+C$

## Question No. 04

i. Considering the following summery of the Cash flows, find the NPV for the following project if the current rate is $10.5 \%$

| Time | Cash flow (\$) |
| :---: | :---: |
| 0 | $(300)$ |
| 1 | 150 |
| 2 | 100 |
| 3 | 80 |

ii. A printing machine is to be replaced in 7 years,. A new machine is expected to cost Rs. 150000 . Assuming an annual interest rate of $6 \%$, what will be the size of each annual savings in order to buy the new printing machine?

## Question No. 05

i. The profit function $P(x, y)=\mathbf{3 6 0 x}+\mathbf{2 0 4 y}-\mathbf{2 4 x y}-\mathbf{3 6} \boldsymbol{x}^{2}-\mathbf{1 8} \boldsymbol{y}^{2}+\mathbf{2 0 0 0}$ of a firm is assumed to have a monopoly on $x$ and $y$, but the markets do not intersect
a. Find the two first order partial derivatives $P_{x}$ and $P_{y}$.
b. Set $P_{x}$ and $P_{y}$ equal to zero and solve for $x$ and $y$.
c. Find the second order partial Derivatives

$$
P_{x x}, P_{y y} \text { and } P_{x y} .
$$

d. Evaluate the second order partial derivatives at the critical points obtained in part (b) .
e. Show that the following condition holds at the critical point

$$
P_{x x} P_{y y}>\left[P_{x y}\right]^{2}
$$

f. Since the above condition is satisfied, the critical point is an extremum point for the profit. Find the extremum profit?

## Question No. 06

i. Prove that the marginal cost MC must be equal to the marginal revenue MR at the profit maximizing level of output.
ii. Total revenue and the total cost functions of a firm are

$$
\begin{aligned}
& R=8400 Q-36 Q^{2} \text { and } \\
& C=9000+480 Q \text { respectively. }
\end{aligned}
$$

a. Set up the profit function $\pi$.
b. Find the critical value/s where $\pi$ is at a relative extremum and test the second order condition.
c. Calculate the maximum profit.

## Question No. 07

i. If $\quad A=\left(\begin{array}{rr}-2 & 5 \\ 7 & -9\end{array}\right)$ and $B=\left(\begin{array}{cc}-4 & 7 \\ 9 & 0\end{array}\right)$

Find the matrix X which satisfies the following relationship $5 A-2 B+4 X=0$
ii. Ms. Sona. invested Rs. 30,000; part at $5 \%$, and part at $8 \%$. The total interest on the investment was Rs. 2,100. Transform this word problem in to a system of simultaneous equations and solve the problem using a matrix method

## Question No. 08

i. If $U(x, y, z)=3 x^{2} y z+4 x y^{2} z+5 y^{4}$, without using Euler's theorem prove that

$$
x \frac{\partial U}{\partial x}+y \frac{\partial U}{\partial y}+z \frac{\partial U}{\partial z}=4 U
$$

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

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

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.

