TAXATION PROGRAMME EXAMINATIONS

CERTIFICATE LEVEL

C2: ECONOMICS & FINANCIAL MATHEMATICS

MONDAY 15TH JUNE 2015

TOTAL MARKS – 100; TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES

1. You have fifteen (15) minutes reading time. Use it to study the examination paper carefully so that you understand what to do in each question. You will be told when to start writing.

2. This question paper consists of FIVE (5) questions of twenty (20) marks each. You MUST attempt all the FIVE (5) questions.

3. Enter your Student number and your National Registration Card number on the front of the answer booklet. Your name must **NOT** appear anywhere on your answer booklet.

4. Do **NOT** write in pencil (except for graphs and diagrams).

5. The marks shown against the requirement(s) for each question should be taken as an indication of the expected length and depth of the answer.

6. All workings must be done in the answer booklet.

7. Present legible and tidy work.

8. Formulae are provided in a separate booklet.

9. Graph paper (if required) is provided at the end of the answer booklet.

Attempt all five (5) questions.

QUESTION ONE

The table below shows the amount of goods (maize and copper) one unit of input can produce in a given period in Country A and Country B:

Country	Maize(units)	Copper(units)
A	50	10
B	120	20

(a) Use both the concepts of absolute advantage and comparative advantage to explain why it is justifiable for country B to trade with country A. (8 marks)

(b) State and explain three (3) functions of the foreign exchange market in Zambia.

(6 marks)

(c) The Balance of Payments is a statistical accounting record of trade and capital transactions.

Give three (3) reasons why the Balance of Payment is important.

(6 marks)

[Total: 20 Marks]

QUESTION TWO

(a) Briefly explain three (3) functions of taxation. (6 marks)

(b) Identify any three (3) measures that you would recommend the government to take for the Kwacha to appreciate against the United States Dollar. (6 marks)

(c) Define the following terms:

(i) Opportunity cost (2 marks)
(ii) Fiscal policy (2 marks)
(iii) Monetary policy (2 marks)
(iv) Secondary Capital Markets (2 marks)

[Total: 20 Marks]

QUESTION THREE

(a) Differentiate between a coupon rate and the yield to maturity. (4 marks)

(b) A company has a chance to buy a bond that has a face value of K1,000. The bond has coupon rate of 8% and matures in 20 years. The market rate of interest is currently 9% per year for similar bonds.

How much should you be willing to pay for the bond? (6 marks)

(c) Construct a schedule for the amortization of a debt of K21,000 with interest at 12% compounded semi-annually by making 6 equal semi annual payments. (10 marks)

[Total: 20 Marks]

QUESTION FOUR

(a) The number of people entering a bank during any two minute interval follows the poisson distribution with mean $\mu = 2$.

Find the probability that during a two-minute interval:

(i) No one enters the bank. (2 marks)

(ii) At least two enter the bank. (4 marks)

(b) The following sample observation has been obtained by an engineer investigating the relationship between weight of final product Y (in kilogrammes) and volume of raw materials X (in litres):

X	Y
14	68
23	105
9	40
17	79
10	81
22	95
5	31
12	72
6	45
16	93

(i) Calculate a least squares regression line from the observed data. (10 marks)

(ii) Calculate the coefficient of determination and interpret your findings. (4 marks)

[Total: 20 Marks]

QUESTION FIVE

(a) A project requires an initial investment of K50,000. It produces a return of K40,000 at the end of year 1 and K30,000 at the end of year 2. Find the exact value of the internal rate of return (**IRR**). (7 marks)

(b) A ten-year bond is originally offered by the government at K1,000 with an annual return of 7%. Assuming that the bond currently has three years left before redemption and that the prevailing interest rate is 8% compounded annually, calculate its present value . (7 marks)

(c) The lifetime of a disk drive head is normally distributed, with mean 1,000 hours and standard deviation of 100 hours. Determine the probability for the following lifetime outcomes for one hard drive unit:

(i) Between 1,000 and 1,150 hours (3 marks)

(ii) 930 or less (3 marks)

[Total: 20 Marks]

END OF PAPER

C 2 ECONOMICS AND FINANCIAL MATHEMATICS

SOLUTIONS

SOLUTION ONE

a. Country B has absolute advantage in the production of both maize and copper. This means that the input concerned is more productive for both goods. However, in terms of opportunity cost we find that copper is cheaper in country A (1Copper: 5Maize) than in country B(1 Copper: 6 Maize). This implies that maize is more expensive in country A(5Maize: 1Copper) and less expensive in country B(6Maize: 1Copper)

   Therefore country A has a comparative advantage in copper while country B has a comparative advantage in maize. So, country B would benefit if it traded with country A.

b. The foreign exchange market performs the following functions:
   i. **Transfer of purchasing power:** The transfer of purchasing power is necessary because international trade and capital transactions normally involves parties living in countries with different national currencies. Each part usually wants to deal in its own currency but the trade or capital transactions can be invoiced in only one single currency.
   ii. **Provision of credit:** because the movement of goods between countries takes time, inventory in transit must be financed through provision of credit.
   iii. **Minimization of foreign exchange risks:** The foreign exchange market provides hedging facilities for transferring foreign exchange risk to someone else. Participants of the FOREX market include; governments, speculators, traders, international companies, banks.

c. The Balance of Payment is relevant because;
   i. It provides detailed information concerning the demand and supply of a countries currency e.g if Zambia imports more than it exports, then the supply of Kwacha will exceed demand and the Kwacha will be under pressure to depreciate against major currencies.
   ii. A country's BOP data may also signal its potential as a business partner for the rest of the world e.g country with BOP difficulties may restrict imports from the outside world and discourage capital outs to sort out the BOP problem. However, one with surplus will expand imports, offer foreign opportunities for foreign enterprises and less restriction on foreign exchange.
   iii. The BOP data can be used to evaluate the performance of the country in international economic competition. If a country experiences BOP deficits year after year then this may signal that the country's domestic industries lack international competitiveness.

SOLUTION TWO

a) The functions of taxation are (any three):

- To raise revenue for the government to finance public and merit goods.
- To redistribute income and wealth
- To protect domestic industries from foreign competition
- To put into effect automatic stabilisers in national income.

b) A strong Kwacha can be achieved by government influence or intervention in the foreign exchange market. This can be done by any of the following:

- Using deflationary policies: These are policies that reduce aggregate demand in the country. They encourage exports and discourage imports
- Using official reserves: The government can use the foreign currency and gold reserves to buy the kwacha. This is a quick and short term measure and is not sustainable as reserves can be depleted.
- Using interest rates: The government can influence the domestic interest rates to increase. This will bring flows of foreign capital into Zambia through portfolio investment. This will increase the demand for the kwacha.

c)

i) Opportunity cost is the second best alternative foregone. It is that which is sacrificed or given up in order to have the other. It arises because of the scarcity of resources

ii) Fiscal policy is the management of the economy through public expenditure, taxation and public borrowing.

iii) Monetary policy is the management of the economy through controlling the quantity of money available and the price of money – the interest rate to be paid by borrowers. It is concerned with control over the growth in money supply, level of interest rates, volume of credit, volume of expenditure in the economy and the exchange rates.

iv) The secondary capital market include stock exchanges(Lusaka Stock Exchange, New York Stock Exchange, Tokyo Nikkei) bond markets, and futures of option markets among others. All these secondary markets deal in the trade of securities.

SOLUTION THREE

a) Coupon rate tells you what the bond paid when it was issued, but the yield to maturity tells you how you will be paid in the future.
Further for premium bonds coupon rate greater than yield to maturity and it is vise-versa for discount bonds.

b)

$F = 1000$, $r = 8\%$, $n = 20$, $i = 9\%$, $C = 1000$

$$Fair\ \ Value = \ P = F \times r\left[\frac{1-(1.+i)^{-n}}{i}\right] + \frac{C}{(1+i)^{n}} = 1000 \times 00.08\left[\frac{1-(1.09)^{-20}}{0.09}\right] + \frac{1000}{(1.09)^{20}}$$

$$= 730.28 + 178.43$$

$$= K908.71$$

c)

$A = 21000$, $i = \frac{0.12}{2} = 0.06$ and $n = 6$, therefore

$$R = \frac{Ai}{1-(1+i)^{-n}} = \frac{(21000)(0.06)}{1-(1.06)^{-6}} = 4270.62$$

Amortization Schedule

Number of Payment	Periodic Payment	Interest at 6%	Principal Repaid	Outstanding Principal
				21000
1	4270.62	1260	3010.62	17989.38
2	4270.62	1079.36	3191.26	14798.12
3	4270.62	887.89	3382.73	11415.39
4	4270.62	684.92	3585.7	7829.69
5	4270.62	469.78	3800.84	4028.85
6	4270.62	241.73	4028.89	-0.04
TOTALS	**25623.72**	**4623.68**	**21000.04**	

SOLUTION FOUR

a) $P(X=x)=\dfrac{e^{\mu}\mu^{x}}{x!} \qquad x=0,1,2\ldots$

For $\mu=2$

i. $P(X=0)=\dfrac{e^{-2}2^{0}}{0!}=0.1353$

ii.

$$P(X\geq 2)=1-P(X\leq 2)=1-\left[P(X=0)+P(X=1)+P(X=2)\right]$$

$$=1-\left[\frac{e^{-2}2^{0}}{0!}+\frac{e^{-2}2}{1!}+\frac{e^{-2}2^{2}}{2!}\right]$$

$$=1-\left[0.1353+0.2707+0.2707\right]$$

$$=1-0.6764$$

$$=0.3234$$

b)

X	Y	X^2	Y^2	XY
14	68	196	4624	952
23	105	529	11025	2415
9	40	81	1600	360
17	79	289	6241	1343
10	81	100	6561	810
22	95	484	9025	2090
5	31	25	961	155
12	72	144	5184	864
6	45	36	2025	270
16	93	256	8649	1488
$\sum X=134$	$\sum Y=709$	$\sum X^2=2140$	$\sum Y^2=55895$	$\sum XY=10747$

Now

$$S_{XX} = \sum X^2 - \frac{\left(\sum X\right)^2}{n} = 2140 - \frac{(134)^2}{10} = 2140 - 1795.6 = 344.4$$

$$S_{XY} = \sum XY - \frac{\left(\sum X\right)\sum Y}{n} = 10747 - \frac{(134)(709)}{10} = 10747 - 9500.6 = 1246.4$$

Therefore,

$$\beta = \frac{S_{XY}}{S_{XX}} = \frac{1246.4}{344.4} = 3.62$$

and

$$\alpha = \overline{Y} - \beta\overline{X} = \frac{709}{10} - 3.62\left(\frac{134}{10}\right) = 70.9 - 48.51 = 23.39$$

Hence, the least –squares regression line is

$$y = \alpha + \beta x = 23.39 - 3.62x$$

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{n\sum X^2 - \left(\sum X\right)^2}\sqrt{n\sum Y^2 - \left(\sum Y\right)^2}} = \frac{10 \times 10747 - 134 \times 709}{\sqrt{10 \times 2140 - 134^2}\sqrt{10 \times 55895 - 709^2}} = 0.895$$

Thus, the coefficient of determination is

$r^2 = 0.895^2 = 0.802.$

The coefficient of determination is 0.802, this implies that 80.2% of the variation in weight of final product is explained by variation in volume of raw materials.

SOLUTION FIVE

a) When NPV=0, then the rate is our internal rate of return, thus;

$$50000 = 40000\left(1+\frac{r}{100}\right)^{-1} + 30000\left(1+\frac{r}{100}\right)^{-2}$$

$$50000\left(1+\frac{r}{100}\right)^{2} = 40000 + 400r + 30000$$

$$50000 + 1000r + 5r^2 = 40000 + 400r + 30000$$

$$5r^2 + 600r - 20000 = 0$$

Solving the quadratic equation gives us

$r = -147.18$ and $r = 27.18$

We discard the negative rate, therefore, the exact internal rate of return is 27%.

b) Since the yield is 7%, then each year the income is K70 with the exception of the last year, when it is K1070 because the bond is redeemed for its original value.

END OF YEAR	CASH FLOW (A)	PRESENT VALUE
1	K70	K64.81
2	K70	K60.01
3	K1070	K849.40
TOTAL P.V		**K974.22**

c)

Let $X =$ Lifetime of a disk hard drive

X is normally distributed with mean 1000 and standard deviation 100 that is $N(1000,10000)$

i)

$$P(1000 \le X \le 1150) = P\left(\frac{1000-1000}{100} \le Z \le \frac{1150-1000}{100}\right) = P(0 \le Z \le 1.5) = 0.4332$$

{2marks for workings and 1mark for correct answer}

ii)

$$P(X \le 930) = P\left(Z \le \frac{930-1000}{100}\right) = P(\le -0.70) = 0.2420$$

{2 marks for workings and 1 mark for correct answer}

END OF SOLUTIONS