



TAXATION PROGRAMME EXAMINATIONS

CERTIFICATE LEVEL

C2: ECONOMICS & FINANCIAL MATHEMATICS

TUESDAY 16TH DECEMBER 2014

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

- (a) Explain the following Macroeconomic issues and why they are of importance to businesses.
- (i) An increase in government spending. (3 marks)
 - (ii) A rise in the rate of inflation. (3 marks)
- (b) Explain what is meant by an expansionary fiscal and monetary policy. (5 marks)
- (c) Discuss the reasons that a government can take to improve the balance of trade in the short term. (5 marks)
- (d) Discuss any five (5) advantages of free trade to an economy like Zambia. (5 marks)

[Total: 20 marks]

QUESTION TWO

- (a) In a two sector economy named "Chibolya" the Marginal Propensity to Save (MPS) is 0.2, investment (I) is K5000 and income (Y) is K2500.
- (i) Assuming investment remains constant what is the equilibrium level of saving and what is the value of the multiplier? (6 marks)
 - (ii) If the investment were to increase by K1000, what would be the new equilibrium level of income? (2 marks)
- (b) One commonly used International Terms of Trade (incoterms) when importing second-hand cars from Japan is "Free on Board" (FOB). Explain any three responsibilities for the importer and any three (3) responsibilities for the exporter under FOB. (6 marks)
- (c) Briefly explain how the following financial derivatives are used to manage foreign exchange rate risks.
- (i) Forward contracts (2 marks)
 - (ii) Currency options (2 marks)
 - (iii) Currency swaps (2 marks)

[Total: 20 marks]

QUESTION THREE

- (a) Define the following terms:
- (i) Yield To Maturity (YTM) (2 marks)
- (ii) The Current Yield (2 marks)
- (b) Dudu buys a car for K120,000 and takes a loan from the bank. Calculate his monthly repayments if the loan is for 5 years. The bank charges 9% interest per annum compounded monthly. (5 marks)
- (c) About 12% of American adults are blacks. The number X of blacks in random samples of 1500 adults should therefore vary with binomial ($n = 1500, p = 0.12$) distribution. What are the mean and the standard deviation of X ? (4 marks)
- (d) The average time required to finish a civil service examination is normally distributed with mean of 60 minutes and a standard deviation of 12 minutes. How many minutes should be allowed for the examination if the supervisor wishes to allow sufficient time for 90 per cent of the applicants to complete the test? (7 marks)

[Total: 20 marks]

QUESTION FOUR

- (a) The table below shows the features of Bond A and Bond B.

	BOND A	BOND B
Coupon	8%	9%
Yield to maturity	8%	8%
Maturity(years)	2	5
Par	K100	K100
Price	K100	K104.06

Assume that each bond pays interest semi-annually. What is the price value of a basis point for bond A? (6 marks)

- (b) Consider the following two Treasury securities:

<u>BOND</u>	<u>Price</u>	<u>Modified duration(years)</u>	
X	\$100		6
Y	\$80		7

Which bond will have the greater dollar price volatility for a 25 basis point change in interest rates. (6 marks)

- (c) A family decides to save some money in an account that pays 9% annual compound interest calculated at the end of each year. They put K2500 into the account at the beginning of each year. All interest is added to the account and no withdrawals are made. How much money will they have in the account on the day after they have made their tenth payment? (8 marks)

[Total: 20 marks]

QUESTION FIVE

- (a) The net cash flow for two projects, X and Y, is as follows:

Year	0	1	2	3	4	5
Project X	-420,000	-5,000	122,000	130,000	148,000	150,000
Project Y	-95,000	-10,000	-120,000	200,000	110,000	-50,000

- (i) Use the net present value criterion to decide which project is the most profitable if a discount rate of 6% and 8% is used. (8 marks)
- (ii) Estimate the internal rate of return of each project. Which project would now be considered more profitable? (7 marks)
- (b) (i) Define a yield curve. (2 marks)
- (ii) Give any three applications of a yield curve. (3 marks)

[Total: 20 marks]

END OF PAPER

C2 SUGGESTED SOLUTIONS

SOLUTION ONE

a) (i) An increase in government spending :

Government spending an injection in the economy, this injection will increase output and an increase in output will generate additional income for the workers and firms. Consequently a second round effect will take place as part of the increased wages and profits are spent on goods and savings.

Incomes of workers and firms will be used for further spending on goods and services but also for taxes.

If a spending income by government is financed by borrowing, interests rates will normally be driven up, and higher interests rates will typically cause investment to decline. This is called crowding-out effect.

(ii) Inflation causes the currency to depreciate when there is a low demand for exports therefore, the demand for the currency is low compared to its supply, and the currency depreciate in value.

Inflation redistribute wealth. It causes borrowers to gain at the expense of lenders as it reduces the value of debts. The lenders receive relative to what they had lent.

Inflation leads to uncertainty in price forecasts, both at central government level and at corporate business level.

With inflation, we have real interests rate which discourages savings and encourages spending. This may have a long term effect on long term finance for investments.

(b) Expansionary macroeconomic policies are designed to increase the level and rate of growth of national income. Expansionary fiscal policy operates via taxes and government expenditure and would include a reduction in taxes and an increase in government spending. Expansionary monetary policy operates through the money supply and credits creation process and would include open market operations and reeducation in the resources that commercial banks need to hold with the central bank.

(c) Short term measures are those which can be implemented quickly, and they would include currency devaluation and restrictions on imports – for example, embargoes, quotas and tariffs.

(d) Five advantages of free trade include:-

- Greater specialisation – Zambia can specialize and increase [production safe in the knowledge that she can export her surplus.
- Economies of scale – Zambia can gain economic of scale from access to the world market.
- Greater availability of goods- This is because of imports.
- Increase competition – Inflow of imports increases efficiency and limits the creation of monopolies.
- Technological Transfer – Zambia can develop her own industries through free movements of capital.
- Political goodwill – Free trade will promote good relations between Zambia and her trading partners.
- Zambia’s resources can be allocated efficiently.

SOLUTION TWO

a) i) In equilibrium $S = I$, so that if investment remains constant at K5 000, the economy will settle in equilibrium where $S = K5\ 000$.

If $MPS = 0.2$, then $MPC = 1 - 0.2 = 0.8$

The Multiplier = $1/(1 - MPC)$ or $1/MPS$
 $= 1/(1 - 0.8)$ or $1/0.2 = \mathbf{5}$

ii) Increase in income = Multiplier X Increase in Investment
 $= 5 \times K1\ 000$
 $= \mathbf{K5\ 000}$

New level of Income = $K25\ 000 + K5\ 000 = \mathbf{K30\ 000}$

b) The mode of transport for this Incoterm is sea or inland waterway.

The seller has the following responsibilities:

- To deliver the goods on board the vessel at the named port of shipment
- To pay the port loading costs
- To provide the buyer with an invoice for the value of goods and related costs
- To provide the buyer with proof of delivery
- To provide the buyer a clean on board receipt
- To pay for transportation, freight and insurance charges to the named port of shipment

The buyer has the following responsibilities:

- To arrange and pay for freight charges from this port
 - To arrange and pay for insurance charges from this port
 - To bear all risks of loss or damages to the goods once they have been loaded
 - To nominate the carrier to transport the goods
 - To pay unloading costs at the place of destination.
- c) i) Forward contracts. A forward contract is a binding contract between a bank and its customer for a purchase or sale of a specified amount of a foreign currency at an agreed future date, at a rate of exchange fixed at the time the contract is made. Once the contract is made, any changes in the exchange rates are irrelevant. It is used to manage exchange rate risk due to fluctuations in the exchange rate.
- ii) Currency options: A currency option is an agreement for the opportunity to buy or sell an amount of a particular currency at a given exchange rate at a stated time in the future. When this time arrives, there is no obligation to honour the option – it can be abandoned. For this privilege the option must be bought. The reason for wishing to participate in such agreement is to reduce or eliminate risk in exchange rate movements
- i) Currency swaps: These are arrangements between two parties to swap payments on each other's loans, those loans being in different currencies.

SOLUTION THREE

- a)
- i. The yield to maturity (YTM) is that discount rate which equates the present value of a bond's cash flow to its price.

ii.
$$\text{Current Yield} = \frac{\text{Annual Coupon Interest Payment}}{\text{Current Price of the Bond}}$$

- b) The number of payment is $n = 60$, the interest rate per period is

$$r = \frac{0.09}{12} = 0.0075 \quad \text{and} \quad A = 120,000.$$

The monthly payment is given by:

$$R = A \frac{r}{1 - (1 + r)^{-n}} = 120,000 \frac{0.0075}{1 - (1.0075)^{-60}} = 120000 \frac{0.0075}{0.361300301} \cong 2491$$

c) i.

$$\text{Mean} = np = 1500 \times 0.12 = 180$$

ii.

$$\text{Standard deviation} = \sqrt{npq} = \sqrt{1500 \times 0.12 \times 0.88} = 12.59$$

d) Mean=60 minutes and standard deviation is 12

$$P\left(Z < \frac{X - 60}{12}\right) = 0.90$$

$$\frac{X - 60}{12} = 1.282$$

$$X - 60 = 15.384$$

$$X = 60 + 15.384 = 75.384$$

Therefore , 75.38 minutes is required.

SOLUTION FOUR

a)

i. For Bond A, we get a bond quote of K100 for initial price if we have a 2 year maturity, an 8% coupon rate and an 8% yield. If we change the yield one basis point so the yield is 8.01%, then we have the following variables and values:

$$F = 100, r = \frac{0.08}{2} = 0.04, C = K4, i = \frac{0.0801}{2} = 0.04005 \quad \text{and} \quad n = 2 \times 2 = 4$$

Then

$$P = C \left[\frac{1 - \left[\frac{1}{(1+i)^n} \right]}{i} \right] + \frac{F}{(1+i)^n} = 4 \left[\frac{1 - \left[\frac{1}{(1.04005)^4} \right]}{0.04005} \right] + \frac{100}{(1.04005)^4} = K14.52 + 85.46 = 99.98$$

For Bond A the price value of a basis point is about
 $K100 - 99.98 = 0.02$ per K100.

b)

The estimated dollar price change in interest rates is obtained by:

For Bond X

$$\begin{aligned} \nabla P &= -(\text{modified duration}) \times \text{Price} \times \text{Basis point Change} \\ &= -(6) \times 100 \times 0.0025 = -\$1.50 \end{aligned}$$

Which is the estimated dollar price change or volatility for a 25 basis point change

$$\text{The percentage change is } \frac{\$-1.50}{\$100} = -0.0150 \text{ or } -1.50\%$$

For Bond Y

$$\begin{aligned} \nabla P &= -(\text{modified duration}) \times \text{Price} \times \text{Basis point Change} \\ &= -(7) \times 80 \times 0.0025 = -\$1.40 \end{aligned}$$

$$\text{The percentage change is } \frac{\$-1.40}{\$80} = -0.0175 \text{ or } -1.75\%$$

Thus, we see that while bond X has greater estimated dollar price volatility compared to Bond Y, it has a lower percentage change in price. From an investor's point of view, every dollar invested in Bond Y has greater volatility.

c).

$$2500 + 2500(1.09) + 2500(1.09)^2 + \dots + 2500(1.09)^9$$

The total amount can be calculated using a geometric series formula with $R = 2500$, $r = 1.09$.

$$S_n = \frac{R(r^n - 1)}{r - 1} = \frac{2500(1.09^{10} - 1)}{1.09 - 1} = 37982.32$$

The family will save about K37,982.32.

SOLUTION FIVE

a)

i. At 6%

Project X:

$$\begin{aligned} NPV_X &= -5000(1.06)^{-1} + 122000(1.06)^{-2} + 130000(1.06)^{-3} + 148000(1.06)^{-4} - 150000(1.06)^{-5} - 420000 \\ &= -4716.98 + 108579.57 + 109150.51 + 177229.86 + 112088.73 - 420000 = 82331.69 \end{aligned}$$

Project Y:

$$\begin{aligned} NPV_Y &= -10000(1.06)^{-1} - 120000(1.06)^{-2} + 200000(1.06)^{-3} + 110000(1.06)^{-4} - 50000(1.06)^{-5} - 95000 \\ &= -9433.96 - 106799.57 + 167923.86 + 87130.30 - 37362.91 - 95000 = 6457.72 \end{aligned}$$

At 8%

Project X:

$$\begin{aligned} NPV_X &= -10000(1.08)^{-1} + 122000(1.08)^{-2} + 130000(1.08)^{-3} + 148000(1.08)^{-4} - 150000(1.08)^{-5} - 420000 \\ &= -4629.63 + 104595.34 + 103198.19 + 108784.42 + 102087.48 - 420000 = -5964.20 \end{aligned}$$

Project Y:

$$NPV_Y = -10000(1.08)^{-1} - 120000(1.08)^{-2} + 200000(1.08)^{-3} + 110000(1.08)^{-4} - 50000(1.08)^{-5} - 95000$$

$$= -9259.26 - 102880.66 + 158766.45 + 80853.28 - 34029.16 - 95000 = -1549.35$$

Therefore, at 6% Project X is better than Project Y and at 8% Project Y is better than Project X.

ii. The internal rate of return *IRR*

Project X:

$$IRR_X = \frac{(6 \times -5964.2) - (8 \times 82331.69)}{-5964.2 - 82331.69} = 7.86$$

$$IRR_Y = \frac{(6 \times -1549.35) - (8 \times 6457.72)}{-1549.35 - 6457.72} = 7.6$$

According to the internal rate of return Project Y is more profitable.

c)

The yield curve is the relationship between the level of interest rate (or cost of borrowing) and the time to maturity of the debt for a given borrower in a given currency.

Application:

- The yield curve is one of the best indicators of current economic conditions as perceived by bond market.
- It is crucial for the pricing of many financial derivatives, as well as consumer credit and mortgage rates for ordinary borrowers.
- Data from the yield curve is used widely by economists in order to predict future economic trends.
- Central banks authorities attach important value to the signals emitted by the yield curve in evaluating the so called inflation expectations of the public.

END OF SUGGESTED SOLUTIONS