TAXATION PROGRAMME EXAMINATIONS

CERTIFICATE LEVEL

C2: ECONOMICS & FINANCIAL MATHEMATICS

MONDAY 14 DECEMBER 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. **Cell Phones** are **NOT** allowed in the Examination Room.
6. 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.
7. All workings must be done in the answer booklet.
8. Present legible and tidy work.
9. Formulae are provided in a separate booklet.
10. Graph paper (if required) is provided at the end of the answer booklet.

Attempt all five (5) questions

QUESTION ONE

(a) Define the following terms in connection with National Income Accounting:

(i) Gross Domestic Product (GDP) (2 marks)
(ii) Economic growth (2 marks)
(iii) Aggregate demand (2 marks)

(b) Explain any two (2) activities that GDP does not measure. (4 marks)

(c) Outline any two (2) factors that can influence the size of the Keynesian multiplier.

(4 marks)

(d) Consider a two hypothetical countries A and B producing two types of goods X and Y as given in the following table:

	GOOD X(Units)	GOOD Y(Units)
COUNTRY A	100	200
COUNTRY B	150	450

(i) Calculate the opportunity cost of the two countries in tabular form. (4 marks)
(ii) Use your answer in (d) (i) to determine how the two countries will trade. (2 marks)

[Total: 20 Marks]

QUESTION TWO

(a) Briefly explain the three (3) main functions of money in Zambia. (6 marks)

(b) Identify any four (4) characteristics of money. (4 marks)

(c) Discuss any four (4) functions of the Bank of Zambia. (8 marks)

(d) Name the two (2) main accounts used in the balance of payments accounting.

(2 marks)

[Total: 20 Marks]

QUESTION THREE

(a) Define the following terms:

(i) A Bond (2 marks)
(ii) Coupon rate (2 marks)
(iii) Yield to Maturity (2 marks)

(b) An investor has a chance to buy a bond that has a face value of K5000. This bond has a 10% coupon rate of interest and matures in 5 years. Interest is paid semi-annually.

Find a purchase price to yield an investor:

(i) 14% compounded semi-annually. (3 marks)
(ii) 8% compounded semi-annually. (3 marks)
(iii) Comment on the outcome of your computations in (i) and (ii) above. (2 marks)

(c) The probability that a second year student in accountancy program will pass all the courses is 0.84.

If there are six students, determine the following probabilities that:

(i) None will pass all the subjects. (3 marks)
(ii) At least five will pass all courses. (3 marks)

[Total: 20 Marks]

QUESTION FOUR

(a) Although the income tax system is structured so that people with higher incomes should pay a higher percentage of their incomes in taxes, there are many loopholes and tax shelters available for people with higher incomes . A sample of seven individuals' 2011 tax returns gave the data listed in the table on income and tax paid.

Individual	Gross Income X (thousand of Kwacha)	Taxes Paid Y (percentage of Income)
1	35.8	16.7
2	80.2	21.4
3	14.9	15.2
4	7.3	10.1
5	9.1	12.2
6	150.7	19.6
7	25.9	17.3

Calculate:

(i) the least squares regression line from the above data. (10 marks)

(ii) the coefficient of determination and comment on your findings. (6 marks)

(b) A trust fund for a 10-year old child is being set up by a single payment so that at age 21 the child will receive K21000. Find how much is the payment , if an interest rate of 6% compounded semi-annually is assumed. (4 marks)

QUESTION FIVE

(a) A project involves an initial outlay of K420,000. The expected cash flow at the end of the next five years is given as:

Year	1	2	3	4	5
Cash flow	-5,000	122,000	130,000	148,000	150,000

Find the internal rate of return (**IRR**). (12 marks)

(b) Anticipated consumer demand for a product next month can be represented by a normal distribution with mean 1200 units and standard deviation 100 units.

Find the probability that:

(i) the sales exceed 1000 units. (4 marks)

(ii) sales will be between 1100 and 1300 units. (4 marks)

END OF PAPER

C2: ECONOMICS AND FINANCIAL MATHEMATICS
SUGGESTED SOLUTIONS
DECEMBER 2015

SECTION A: ECONOMICS

SOLUTION ONE

a)

i) Gross Domestic Product is the value of all final goods and services produced within the boundaries/borders of a country within a given period.

ii) Economic growth is the increase in GDP or level of production when two different periods are compared.

iii) Aggregate demand in the economy is the sum of all the spending made by households, firms, government, and foreign sector on goods produced in the country.

b) Two (2) activities not measured by GDP include any of the following:

- **Economic "bads**": GDP is not a good measure of overall economic welfare because while it takes into account the positive value of economic activity, the negative externalities from such activity such as pollution is not deducted from GDP to give a true value.

- **Income distribution**: GDP does not take into account the distribution of income. For example, a country may have very high GDP per capita with the majority wallowing in poverty.

- **Non-market production**: GDP does not take into account the production of those goods and services which do not go through the market, i.e. Do-it-yourself activities.

- **Underground economy**: This is part of an economy with transactions or activities that are never recorded either because they are illegal such as smuggling or drug-trafficking, or cash transactions aimed at evading taxation.

c) The multiplier is simply a ratio expressed as follows:
Multiplier = Final change in expenditure/Initial change in injections. It magnifies any initial change in injections, say investment or government expenditure, making the final increase in expenditure in the economy greater.

d) Its size is determined by:

- **Marginal Propensity to Consume** (MPC). This is the percentage of any extra income that will be spent on consumption. Thus, multiplier = 1/(1-MPC) or alternatively, Multiplier = 1/MPS.

- **Withdrawal or leakages**: This focusses on what happens to the extra income if it has not been spent on consumption. This restrict the amount of additional income that is spend on each spending round following the initial rise in injections. The leakages include level of savings, level of taxation, and demand for imports.

i) Solution on the table below

	Good X	Good Y
Country A	1	2
Country B	1	3

Country A has a lower opportunity cost in the production Good X(2:3), therefore it has a comparative advantage in the production of Good X.

	Good X	Good Y
Country A	$\frac{1}{2}$	1
Country B	$\frac{1}{3}$	1

Country B has a lower opportunity cost in the production Good Y ($\frac{1}{3} : \frac{1}{2}$) therefore it has a comparative advantage in the production of Good Y.

ii) So country A will produce and export good X to country B and country B will produce and export good Y to country A.

SOLUTION TWO

a) The existence of money is essential to the working of the modern economy. This is because money serves functions that are important to the modern society. The functions of money are:

- Money as a medium of exchange: Money facilitates the exchange of goods. Buyers and sellers meet and trade easily without the convenience of the barter system.
- Money as a unit of account: Money acts as a common measure of the unit of account for goods and services. Money makes possible the operation of the price system.
- Money as a store of value: Money is the most convenient way of keeping income. Money is a store of wealth and can be converted almost immediately into a medium of exchange without loss of value.
- Money as a means for deferred payments: Money makes possible for payments to be deferred from the present to some future date. Borrowing and lending are simplified.

b)

i) Acceptability
ii) Durability
iii) Portability
iv) Divisibility
v) Homogeneity
vi) Scarcity and stability

c) The following are the functions of the Bank of Zambia as provided by the two Acts of Parliament:

- Banker to the banking system
- Banker to the government
- Implementation of monetary policy
- Fiscal agent of the government
- Prudential supervision of banking and financial system
- Foreign exchange supervision

d) The BOP is composed of the following:

- The Current Account
- Capital Account
- The Official Reserves Account
- Statistical Discrepancy

SECTION B: FIMANCIAL MATHEMATICS

SOLUTION THREE

a)

i) A Bond is a contract or certificate of debt in which the issuer promises to pay the holder a definite sequence in a period of time.

ii) The Coupon Rate is the rate at which the bonds pay interest of its face value at the regular time intervals until the redemption date.

iii) The Yield to Maturity of a bond is the discount rate that equates today's bond price with the present value of the future cash flows of the bond.

b)

i)

$$F = 5000\ ,\quad r = \frac{10}{2}\% = 5\%\ \ ,\ n = 5\times 2 = 10\ \ ,\ i = \frac{14}{2}\% = 7\%,\ C = 5000$$

$$Fair\quad Value = \ P = F \times r\left[\frac{1-(1.+i)^{-n}}{i}\right] + \frac{C}{(1+i)^{n}} = 5000\times 0.05\left[\frac{1-(1.07)^{-10}}{0.07}\right] + \frac{5000}{(1.07)^{10}}$$

$$= 1755.90 + 2541.75$$

$$= K4297.65$$

ii)

$$F = 5000\ ,\quad r = \frac{10}{2}\% = 5\%\ \ ,\ n = 5\times 2 = 10\ \ ,\ i = \frac{8}{2}\% = 4\%,\ C = 5000$$

$$Fair\quad Value = \ P = F \times r\left[\frac{1-(1.+i)^{-n}}{i}\right] + \frac{C}{(1+i)^{n}} = 5000\times 0.05\left[\frac{1-(1.04)^{-10}}{0.04}\right] + \frac{5000}{(1.04)^{10}}$$

$$= 2027.72 + 3377.82$$

$$= K5405.54$$

iii) The coupon rate in (i) is lower than the yield rate to maturity, thus the face value is higher than the maturity value. It is vice-versa for (ii).

c) Let $X =$ the number of second year accountants that will pass all courses.

X is binomial with $n = 6$ and $p = 0.84$

i) $P(X = 0) = {}^{6}C_{0}(0.84)^{0}(0.16)^{6} = 0.0002$

ii) $P(X \geq 5) = P(X = 5) + P(X = 6) = {}^{6}C_{5}(0.84)^{5}(0.16)^{1} + {}^{6}C_{6}(0.84)^{6}(0.16)^{0}$
$= 0.4015 + 0.3513$
$= 0.7528$

SOLUTION FOUR

a)

X	Y	X^2	Y^2	XY
35.8	16.7	1281.64	278.89	597.86
80.2	21.4	6432.04	457.96	1716.28
14.9	15.4	222.01	237.16	229.46
7.3	10.1	53.29	102.01	73.73
9.1	12.2	82.81	148.84	111.02
150.7	19.6	22710.49	384.16	2953.72
25.9	17.3	670.81	299.29	448.09
$\sum X = 323.9$	$\sum Y = 112.7$	$\sum X^2 = 31453.09$	$\sum Y^2 = 1908.31$	$\sum XY = 6130.16$

Now

$$S_{XX} = \sum X^2 - \frac{(\sum X)^2}{n} = 31453.09 - \frac{(323.9)^2}{7} = 31453.9 - 14987.32 = 16465.77$$

$$S_{XY} = \sum XY - \frac{(\sum X)\sum Y}{n} = 6130.16 - \frac{(323.9)(112.7)}{7} = 6130.16 - 5214.79 = 915.37$$

Therefore,

$$\beta = \frac{S_{XY}}{S_{XX}} = \frac{915.37}{16465.77} = 0.056$$

and

$$\alpha = \overline{Y} - \beta\overline{X} = \frac{112.7}{7} - 0.056\left(\frac{323.9}{7}\right) = 16.1 - 2.59 = 13.51$$

Hence, the least –squares regression line is

$$y = \alpha + \beta x = 13.51 - 0.056x$$

ii)

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{n\sum X^2 - \left(\sum X\right)^2}\sqrt{n\sum Y^2 - \left(\sum Y\right)^2}} = \frac{7(6130.16) - (112.9)(323.9)}{\sqrt{7 \times 31453 - (323.9)^2}\sqrt{7 \times 1908.31 - (112.7)^2}} = 0.74$$

Thus, the coefficient of determination is

$$r^2 = 0.74^2 = 0.542$$

The coefficient of determination is 0.542, this implies that 54.2% of the variation in taxes paid is explained by variation in gross income.

b) $S = 27000$, $r = \frac{0.06}{2} = 0.03$, $n = 22$.

$$P = S(1+r)^{-n} = 27000(1.03)^{-22} \cong 14091.10$$

SOLUTION FIVE

a)

$$r = \frac{\sum_{t=1}^{5} P_t - A}{\sum_{t=1}^{5} tP_t} = \frac{545000 - 420000}{1971000} = 0.0634192$$

Point A at 6%

$$NPV_A = -5000(1.06)^{-1} + 122000(1.06)^{-2} + 130000(1.06)^{-3} + 148000(1.06)^{-4} + 150000(1.06)^{-5} - 420000$$
$$= 22331.68$$

Point B at 7%

$$NPV_B = -5000(1.07)^{-1} + 122000(1.07)^{-2} + 130000(1.07)^{-3} + 148000(1.07)^{-4} + 150000(1.07)^{-5} - 420000$$
$$= 7184.67$$

Point C at 8%

$$NPV_C = -5000(1.08)^{-1} + 122000(1.08)^{-2} + 130000(1.08)^{-3} + 148000(1.08)^{-4} + 150000(1.08)^{-5} - 420000$$
$$= -5964.20$$

Considering point B and C:

$$IRR = \frac{(r_B \times NPV_C) - (r_C \times NPV_B)}{NPV_C - NPV_B} = \frac{(0.07)(-5964.20) - (0.08)(7184)}{-5964.20 - 7184.67} = 0.07545$$

Therefore, the internal rate of return is 7.545%

b)

Let $X =$ Anticipated consumer demand for a product next month.

X is normally distributed with mean 1200 and standard deviation 100

i)

$$P(X \geq 1000) = P\left(Z > \frac{1000-1200}{100}\right) = P(Z > -2) = 0.9772$$

ii).

$$P(1100 \leq X \leq 1300) = P\left(\frac{1100-1200}{100} \leq Z \leq \frac{1300-1200}{100}\right) = P(-1 \leq Z \leq 1) = 0.6824$$

END OF SOLUTIONS