THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

SPECIAL /SUPPLEMENTARY EXAMINATION

ACS 403: FINANCIAL ECONOMICS

Date: JULY 2019	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) What is financial economics? **(2 marks)**

b) Explain the three forms of the Efficient Markets Hypothesis **(3 marks)**

c) Discuss the three types of multifactor models of asset returns **(3 marks)**

d) List any three assumptions of APT **(3 marks)**

e) An investor has the choice of the following assets that earn rates of return as follows in each of the four possible states of the world:

State	Probability	Asset 1	Asset 2	Asset 3
1	0.2	5%	5%	6%
2	0.3	5%	12%	5%
3	0.1	5%	3%	4%
4	0.4	5%	1%	7%
	Market capitalisation	10,000	17,546	82,454

Determine the market price of risk assuming CAPM holds.
Define all terms used.

(8 marks)

f) Why study financial economics in higher education level? **(4 marks)**

g) An investor is contemplating an investment with a return of £ R , where: R = 300,000 - 500,000U where U is a uniform [0,1] random variable.
Calculate each of the following four measures of risk:

i. variance of return **(2 marks)**

ii. downside semi-variance of return

(1 mark)

iii. shortfall probability, where the shortfall level is Kshs 100,000

(2 marks)

iv. Value at Risk at the 5% level.

(2 marks)

Q2. i) Two assets are available for investment. Asset 1 returns a percentage 4 B%, where B is a Binomial random variable with parameters n = 3 and p = 0.5. Asset 2 returns apercentage 2P%, where P is a Poisson random variable with parameter μ = 3. Assume a benchmark return of 3%. Calculate the following three measures of investment risk for each asset:

a) Variance **(3 marks)**
b) Semi-variance and **(3 marks)**
c) Shortfall probability **(4 marks)**

ii) An investor can construct a portfolio using only two assets A and B with the following properties:

	A	B
Variance of return	24%%	12%%

Correlation coefficient between assets 0.25
Derive a formula for and determine the composition of the investor's minimum variance portfolio.

(10 marks)

Q3. a) A market consists of three assets A, B and C. Annual returns on the three assets (RA, RB and RC) have the following characteristics:

Asset	Expected return %	Standard deviation %
A	9	20
B	6	20
C	3	10

The correlation between the returns are as follows: Corr(RA, RB) = -¼, Corr(RB, RC) = -½ and Corr(RA, RC) = -½.
Calculate the variance of the returns of each asset and the covariances between the returns of each pair of assets

(10 marks)

b) Explain five properties of Standard Brownian motion **(10 marks)**

Q4. i) Explain what is meant by self-financing in the context of continuous-time derivative pricing, defining all notation used **(6 marks)**

(ii) Define the delta of a derivative, defining all notation and terms used other than those already defined in your answer to (i) **(6 marks)**

(iii) Explain how delta and self-financing are used in the martingale approach to valuing derivatives **(8 marks)**

Q5. i) State the assumptions underlying the Black-Scholes option pricing formula **(6marks)**

A discounted stock price can be written as: $S_t = \cosh(\sigma Z_t) \exp(-\sigma 2t)$, where Z_t is a standard Brownian motion under the real world measure P .
Hint: $\cosh(x) = (ex + e - x)/2$.

ii) Apply Ito's formula to derive an SDE satisfied by S_t **(8marks)**

iii) Explain why the discounted stock price (under P) is not a martingale **(2 marks)**

iv) State the SDE satisfied by S_t under the equivalent martingale measure **(4 marks)**

END