BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF BANKING AND FINANCE

FINANCIAL ENGINEERING (BS452)

DURATION: THREE HOURS

NOV 2024

INSTRUCTIONS TO CANDIDATES:

1) Answer any **four** questions.

2) Candidates will need non-programmable calculators.

3) Each question carries equal marks as indicated in square brackets.

4) Electronic data saving devices are not allowed into the examination halls.

ADDITIONAL MATERIAL

Standard Normal Distribution Tables

QUESTION ONE

a) Explain the uses of synthetics in financial engineering (5)

b) Using a formal argument, prove that the lower bound of a European Call option is given by $C \geq S_0 - Ke^{-rt}$ (10)

c) Given that $S_0 = 20$, $K=18$, $r=10\%$ and $T=1$, demonstrate how an arbitrageur will make a riskless profit if the condition stated in b) above does not hold. Assume the call price is $3. (10)

[25 MARKS]

QUESTION TWO

a) Explain the importance of creating collateralized debt obligations in the credit markets. (5)

b) A trader has taken a short position on 500 call contracts on day 0 when the spot price of the underlying asset is at 28$ accompanied by a volatility of 30%, risk-free rate of 8% and a strike price of 28$. The time to maturity of the option is 30 days and the trading calendar

is 365days. The behavior of the price process is such that it is at $27.5 on day 1, $27.90 on day 2.

i. Compute the prices of the call option for days 0, 1 and 2. (10)

ii. Conduct a hedging analysis between day 0 and day 1 (5)

iii. Conduct a hedging analysis between day 1 and day 2 (5)

[25 MARKS]

QUESTION THREE

a) Describe how a swaption can be used by swap traders (6)

b) XYZ Bank has the following balance sheet; equity capital = 60m, regulatory capital is expected to be 15%.

Asset	**Value (Millions)**	**Risk Category**	**Risk Adjusted Value (Millions)**
Cash	90	0%	0
Government Bonds	120	0%	0
Mortgages	340	50%	170
Commercial Loans	400	100%	400
Total	**950**		**570**

Required:

Using relevant computations;

i. Show the extent to which the bank is undercapitalized. (2)

ii. Show how the bank can use securitization to recapitalize and reach the minimum threshold. (10)

c) Explain the impact of an increase in dividends and interest rates on the value of a call option. (7)

[25 MARKS]

QUESTION FOUR

a) Define a plain-vanilla swap. (3)

b) Prove the equivalents of a fiduciary call and protective put. (10)

c) Explain what is meant by the gamma of an option position? What are the risks in the situation where the gamma of a position is large and negative and the delta is zero?

(5)

d) Explain the two ways a credit default swap can be settled. (7)

[25 MARKS]

QUESTION FIVE

a) James Delport is an options trader at a large bank. He sold to a client one-month put options on 2,000 shares of an underlying equity. The options have an exercise price of 1,300 euros (EUR) and an option premium of EUR 19.09 per share. The underlying equity is trading at EUR 1,340 per share. The options were priced using a volatility of 24%. Delport calculates the delta of the options to be –0.3088. Delport needs to hedge his exposure and decides to trade in the underlying equity's shares.

i. Determine whether Delport should buy or sell shares of the underlying equity. (4)

ii. Calculate the number of shares he should trade. (6)

b) Explain three (3) factors that have led to the growth of financial engineering. (12)

c) Explain why a total return swap can be useful as a financing tool. (3)

[25 MARKS]

QUESTION SIX

Explain the implications of the bad lemons theory in the design and trading of financial assets. (25)

END OF EXAMINATION