



The Co-operative University of Kenya

END OF SEMESTER EXAMINATION DECEMBER-2016

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN FINANCE (YR III SEM I)

UNIT CODE: CMFI 2306

UNIT TITLE: FINANCIAL MATHEMATICS

DATE: 15TH DECEMBER, 2016

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS:

- Answer question **ONE (compulsory)** and any other **TWO** questions

QUESTION ONE

- Differentiate between:
 - accumulation and discounting. (2 marks)
 - Increasing and decreasing annuity. (2 marks)
- Determine the number of years after which an amount of Ksh 35,000 would accumulate to 58,000 using:
 - Simple rate of interest of 7% per annum. (2 marks)
 - Compound interest of 7% effective per annum. (2 marks)
- Determine the present value of an annuity of Shs 50,000 per annum for three years at an effective interest rate of 10% if Payment is made:
 - Annually in arrears. (2 marks)
 - Annually in advance. (2 marks)
 - Quarterly. (2 marks)
 - Monthly. (2 marks)
 - Continuously. (2 marks)
- John intends to deposit Shs 50,000 per annum in a bank savings account. He intends to increase his savings by Shs 10,000 per annum starting from the second year. The pays interest at the rate of 10% per annum.
Required:
 - The accumulated amount in the bank account after 10 years. (5 marks)
 - The present value of the amount at an effective interest rate of 12%. (3 marks)
- A company has borrowed £500,000 from a bank. The loan is to be repaid by level instalments, payable annually in arrear for ten years after a grace period of 3 years from the date the loan is made.
The annual instalments are calculated at an effective rate of interest of 9% per annum.
Calculate the amount of the level annual instalments. (4 marks)

QUESTION TWO

- A loan is repayable by annual installments paid in arrear for 20 years. The first installment is £4,650 and each subsequent installment is £150 greater than the previous installment. Calculate the following, using an interest rate of 9% per annum effective:
 - The amount of the original loan. (5 marks)
 - the capital repayment in the tenth installment. (5 marks)
 - the interest element in the last installment. (5 marks)
 - the total interest paid over the whole 20 years. (5 marks)

QUESTION THREE

- Briefly explain three merits of net book value over the payback period. (6 marks)

- b. Differentiate between the retrospective and the prospective techniques as used in financial mathematics. (4 marks)
- c. A company issues ordinary shares to an investor. Under the terms of the ordinary share issue, the investor is to purchase 1,000,000 shares at a purchase price of Sh 45 each on 1 January 2016. No dividend is expected to be paid for 2 years. The first dividend payable on 1 January 2018 is expected to be Sh 5 per share. Dividends will then be paid every 6 months in perpetuity. The two dividend payments in any calendar year are expected to be the same, but the dividend payment is expected to increase by Sh 0.15 at the end of each year.
Calculate the net present value of the investment on 1 January 2016 at an effective rate of interest of 8% per annum. (10 marks)

QUESTION 4

- a. Differentiate between the following terms:
 - i. Perpetual annuity and increasing annuity. (2 marks)
 - ii. Continuous annuity and deferred annuity. (2 marks)
 - iii. Annuity due and ordinary annuity. (2 marks)
- b. XYZ limited issued 10% debentures at a par value of Shs 1000. The debentures are redeemable after 5 years at a value of Shs 950. Determine the intrinsic value of the debenture given that the cost of capital of the company is 12%. (5 marks)
- c. A company is undertaking a new project. The project requires an investment of £5m at the outset, followed by £3m three months later. It is expected that the investment will provide income over a 15-year period starting from the beginning of the third year. Net income from the project will be received continuously at a rate of £1.7m per annum. At the end of this 15-year period there will be no further income from the investment.
Calculate at an effective rate of interest of 10% per annum:
 - (i) The net present value of the project. (5 marks)
 - (ii) The discounted payback period. (4 marks)

QUESTION 5

A particular charity invests its assets in a fund on which it has a target rate of return of 8% per annum effective. From time-to-time, the charity also invests in projects that help achieve its charitable objectives whilst providing a rate of return. Projects that are accepted by the charity must fulfill each of the following criteria:

1. A minimum annual effective internal rate of return of 2% less than the target return on the investment fund.
2. A payback period of no more than ten years.
3. A positive cash flow during the fifth year or earlier.

The charity is considering investing in a social enterprise project that involves providing loans to farmers in low-income countries to help them develop better resilience against poor weather conditions. The details are as follows:

- The project involves making loans of £1m at the start of each year for three years, the first loan being made at the beginning of 2017.
- The loans will be paid back from the extra income obtained by the farmers from the beginning of 2020.
- The repayments in each year will be through level monthly installments paid in advance with the rate of payment of the installments increasing by £25,000 per year for 10 years after which the payments stop.
- The annual rate of repayment in 2020 will be £495,000.
- The charity will also incur costs at the end of each of the years in which income is received of £50,000 per annum.

- (i) Explain why, in general, the payback period is not an appropriate decision criterion for an investment project. (6 marks)
- (ii) Determine which of the three criteria used by the charity are met in this case. (14 marks)