

**Faculty of Actuarial Science and Statistics**

**Undergraduate Coursework Submission Form**

Complete the details below, attach the form to your coursework and **POST it in the Actuarial Coursework Box** no later than **3pm** on the due date on the Second Floor of the Parkes Building. All late coursework **MUST** be posted in the same box, not handed to your Lecturer/Tutor.

<b><u>Student to complete</u></b>	
Name .....	
Degree Course .....	Year .....
Subject Title ..Financial and Investment Mathematics II.....	
Lecturer/Tutor Name ..... Mr Rickayzen .....	
Set Date .....26 <sup>th</sup> October 2004.....	Submission Deadline 17 <sup>th</sup> Nov 2004.....
I confirm that the work is my own, that I have not copied the work of others, and that I have referenced the work of other authors in an appropriate way.	
Signed .....	

If you are unable to finish the coursework by the submission deadline you should see your lecturer, or tutor, taking any medical certificates with you, to obtain authorisation to submit your work after the deadline.

<b><u>Lecturer/Tutor to complete</u></b> <b>Authorised Late Submission</b>  Revised submission Date: Reason: Authorised by:	Date Submitted
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<b><u>Lecturer/Tutor to complete</u></b>	
Final Mark	If penalties were applied:
	Raw Mark:
	Marks Deducted:
	Reason for Deduction:

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Name .....	<div style="border: 1px solid black; padding: 10px; min-height: 60px;"><b>Faculty Stamp</b></div>
Subject title .....	
Date of Submission .....	

**Please retain this as a receipt of submission**

### Question 1

In July 2001 the government of a country issued an index-linked bond of term 2 years. Coupons were payable half-yearly in arrears, and the annual nominal coupon rate was 4%.

Interest and capital payments were indexed by reference to the value of an inflation index with a time lag of 6 months.

A tax-exempt investor purchased £100,000 nominal at issue and held it to redemption. The issue price was 98%.

You are given the following values of the inflation index:

<i>Date</i>	<i>Inflation Index</i>
January 2001	110.5
July 2001	112.1
January 2002	115.7
July 2002	119.1
January 2003	123.2

- (i) Calculate all the investor's cash flows from this investment and state the month when each occurs.
- (ii) Show that the effective money yield obtained by the investor was 11% per annum.

[Total 7 marks]

### Question 2

An investor is interested in purchasing a certain office block.

Rental income will be received continuously for 50 years at an initial rate of £90,000 per annum. Rents are increased every 5 years at a rate of 4% per annum compound, the first such increase taking place 5 years after purchase.

The property reverts to its original owner after 50 years for no payment. The investor estimates that £250,000 will need to be spent to refurbish the offices 6 months after the purchase date.

The investor requires an internal rate of return of 12% per annum. Assuming that the investor pays no tax, calculate the price that the investor would be willing to pay.

[8 marks]

### Question 3

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 £0.45 each.

No dividend is expected to be paid for 2 years. The first dividend payable in 2 years time is expected to be £0.05 per share. Dividends will then be paid every 6 months in perpetuity. The two dividend payments within any one year are expected to be the same, but the total annual rate of dividend is expected to increase at a rate of 3% per annum compound.

Assuming that the investor pays income tax at 20%, calculate the net present value of the investment at an effective rate of interest of 8% p.a.

[8 marks]

### Question 4

An investor is considering purchasing a fixed interest bond at issue which pays half yearly coupons at a rate of 6% per annum. The security will be redeemed at 105 in 10 years time.

The investor is subject to income tax at 20% and capital gains tax at 25%.

Assuming a constant inflation rate of 2.857% per annum, calculate the price of £100 nominal if the investor is to obtain a net real yield of 5% per annum.

[11 marks]

### Question 5

A loan stock was issued on 1<sup>st</sup> July 1999 with interest at 10% per annum payable quarterly in arrears.

The loan stock is repayable at 110% on either the 10<sup>th</sup> or 15<sup>th</sup> anniversary of issue, the actual date being chosen by the borrower. All investors pay income tax at 25% on coupon payments only.

- (i) Find the issue price per £100 nominal which would provide the purchaser with a net yield of at least 6% per annum effective. [8]
- (ii) Using the same assumptions as in (i), calculate the ex-dividend price exactly 2 months after issue. [4]

[Total 12 marks]

### Question 6

An economist's model of interest rates indicates that the  $n$  year spot rate of interest is:

$$\frac{1}{10(1 + e^{-0.2n})}$$

Assuming that the model is correct and that there are no changes in the term structure of interest rates in future, calculate:

- (i) The price of a 10 year zero coupon bond purchased now. [3]
- (ii) The price of a 10 year zero coupon bond purchased in 5 years time. [4]
- (iii) The one year forward rate at time 5 years. [4]
- (iv) The 3 year par yield. [5]

[Total 16 marks]