

Subject CM1

CMP Upgrade 2021/22

CMP Upgrade

This CMP Upgrade lists the changes to the Syllabus objectives, Core Reading and the ActEd material since last year that might realistically affect your chance of success in the exam. It is produced so that you can manually amend your 2021 CMP to make it suitable for study for the 2022 exams.

Alternatively, you can buy a full set of up-to-date Course Notes / CMP at a significantly reduced price if you have previously bought the full-price Course Notes / CMP in this subject. Please see our 2022 *Student Brochure* for more details.

We only accept the current version of assignments for marking, *ie* those published for the sessions leading to the 2022 exams. If you wish to submit your script for marking but have only an old version, then you can order the current assignments free of charge if you have purchased the same assignments in the same subject in a previous year, and have purchased marking for the 2022 session.

This CMP Upgrade contains:

- all significant changes to the Syllabus objectives and Core Reading
- additional changes to the ActEd Course Notes and Assignments that will make them suitable for study for the 2022 exams.

0 Retaker discounts

When ordering *retaker-price material*, please tick the relevant box when using the e-store.

Students have the choice of purchasing the full CMP (printed or eBook) or just the Course Notes (printed).

Further information on retaker discounts can be found at:

www.acted.co.uk/paper_reduced_prices.html

1 Changes to the Syllabus

This section contains all the *non-trivial* changes to the syllabus objectives.

Credit cards and current accounts have been added to the list of financial instruments in objective 1.2.2. It now reads as follows:

- 1.2.2 Describe in the form of a cashflow model the operation of financial instruments (like a zero-coupon bond, a fixed-interest security, an index-linked security, a current account, cash on deposit, a credit card, an equity, an interest-only loan, a repayment loan and an annuity-certain) and an insurance contract (like endowment, term assurance, contingent annuity, car insurance and health cash plans).

2 Changes to the Core Reading and ActEd text

This section contains all the *non-trivial* changes to the Core Reading and ActEd text.

Chapter 2

Section 2

Two sections of core reading have been added for the new financial instruments in syllabus objective 1.2.2:

This new material is added between sub-sections 2.6 'An annuity-certain' and 2.7 'An 'interest only loan' *ie* between pages 10 and 11 of the 2021 notes.

A credit card

Credit cards allow flexible borrowing, generally known as revolving credit. Credit card holders can spend up to their agreed credit limit and must pay back a minimum amount each month. Credit card holders are divided between 'transactors', who repay in full each month, and 'revolvers' who take advantage of flexible borrowing and repayments.

Credit cards charge interest on amounts borrowed and fees for late payments and other services. Many 'transactors' pay no charges on their credit cards.

Cashflows on credit cards are uncertain and are hard to model because they depend on customer behaviour which can change over time. For example, customers who are getting into financial difficulties may increase their borrowing up to their agreed credit limit and then default.

A current account

Current accounts are 'bundled' products which allow both savings and borrowing (through overdrafts) and enable payments by various methods including cash withdrawals, debit cards, direct debits, online and mobile payments and cheques.

Current accounts typically charge interest on overdrafts and various fees, which may include regular monthly charges and/or fees for certain transactions. In the UK, banks typically do not make monthly charges (except for packaged current accounts with loyalty benefits) and many current account customers enjoy 'free-if-in-credit' banking.

Indeed, any savings within a current account may accrue interest and so current accounts and cash on deposit are very similar. The main difference is the ability to borrow through a current account.

As for credit cards, cashflows on current accounts are uncertain and, because they depend on customer behaviour, are hard to model.

Chapter 11

Section 3

The first line of the solution to (i)(a) at the bottom of page 21 has been corrected to read as follows:

$$100,000 = 140,000(1 + i_C)^{-5} \quad \Rightarrow \quad i_C = \left(\frac{140,000}{100,000} \right)^{1/5} - 1 = 7.0\% \quad (\text{to 1 dp})$$

Chapter 12

Section 5

A new section 5 has been added on variable rate securities:

Variable rate securities, such as floating rate notes, are investments on which interest payments may be tied to a reference interest rate.

In banking, many loans and deposits are variable rate, and banks are the main issuers of floating rate notes (FRNs).

Interest payments on FRNs are normally paid quarterly and are set at the beginning of each period as a stated spread, which remains fixed, above a variable reference rate such as LIBOR (London Inter-bank Offered Rate) or SONIA (Sterling Overnight Index Average).

In the UK, LIBOR has traditionally been used as a 'risk-free' rate against which interest payments may be defined *eg* interest is payable at LIBOR + 0.25%. The spread here is 0.25% *ie* the interest received or payable in excess of the risk-free rate. LIBOR is due to be replaced as the risk-free rate in the UK by SONIA with the transition occurring at the end of 2021 (at the time of writing).

Floating rate securities are covered in more detail in Subject SP5, Investment and Finance.

Chapter 17

The first line of the solution on page 30 has been corrected to read:

$$\bar{A}_{50:\overline{2}|} = \bar{A}_{50:\overline{2}|}^1 + A_{50:\overline{2}|}^1$$

Chapter 22

Page 5

Near the bottom of this page, the first line underneath the solution has been corrected and now reads:

Using the solution above and writing ${}_t q_y = \int_{s=0}^{s=t} {}_s p_y \mu_{y+s} ds$, we see that:

Chapter 22

Page 5

Near the bottom of this page, the first line underneath the solution has been corrected and now reads:

Using the solution above and writing ${}_tq_y = \int_{s=0}^{s=t} {}_sp_y \mu_{y+s} ds$, we see that:

Chapter 27

Question 27.7 has been amended to remove net premium reserves and replace with known reserves at the start of years 2 and 3. The solution has been amended accordingly.

Replacement pages with the amended questions and solutions are attached.

3 Changes to the X Assignments

Assignment X4

Additional wordspeak solutions provided in 2021 have been incorporated into the assignment solutions in 2022 to form a single document.

X4.10

Definitions of P and K_{60} are no longer required for the full 2 marks in part (i).

X4.14

The half mark awarded for $P\bar{a}_{x:\overline{20}|} = 715.14$ in part (ii) has been removed, awarded instead for the following line of working:

$$\bar{a}_{x:\overline{20}|} = \int_0^{20} e^{-\delta t} {}_t p_x dt \quad \left[\frac{1}{2} \right]$$

Assignment X5

X5.12

The line to earn the third mark in part (i) has been amended to:

For this particular policy, the death strain at risk is the amount of money, over and above the year-end reserve, that has to be paid in respect of each death during the policy year $(t, t+1)$. [1]

4 Changes to the Y Assignments

Some columns have been removed from the answer templates to make them more reflective of past Paper B exam templates.

Assignment Y1

1(i)

The following column headings have been removed from the answer template:

- Discount factor (column M)
- Present value of net monthly cashflow (column N)
- Total NPV of cashflows to date (column O)

1(iv)

The following column headings have been removed from the answer template:

- Balance (start of month) (column M)
- Interest (column N)
- Balance (end of month) (column O)

Assignment Y2

1(iii)

The following column headings have been removed from the answer template:

- Reserves at start of yr (column W)
- Interest on reserves (column X)
- Cost of reserves needed at end of yr (column Y)
- Profit vector (column Z)
- Prob in force at st of yr (Column AA)
- Profit signature (Column AB)
- Discount factor (Column AC)
- EPV (Column AD)

5 Other tuition services

In addition to the CMP you might find the following services helpful with your study.

5.1 Study material

We also offer the following study material in Subject CM1:

- Flashcards
- Revision Notes
- ASET (ActEd Solutions with Exam Technique) and Mini-ASET
- Mock Exam and AMP (Additional Mock Pack).

For further details on ActEd's study materials, please refer to the *2022 Student Brochure*, which is available from the ActEd website at www.ActEd.co.uk.

5.2 Tutorials

We offer the following (face-to-face and/or online) tutorials in Subject CM1:

- a set of Regular Tutorials (lasting a total of five days)
- a Split Block Tutorial (lasting five full days)
- a Preparation Day for the computer-based exam
- six-day Bundles in both Regular and Block format, covering the five days for the Paper A exam, plus the Preparation Day for the computer-based exam
- an Online Classroom.

For further details on ActEd's tutorials, please refer to our latest *Tuition Bulletin*, which is available from the ActEd website at www.ActEd.co.uk.

5.3 Marking

You can have your attempts at any of our assignments or mock exams marked by ActEd. When marking your scripts, we aim to provide specific advice to improve your chances of success in the exam and to return your scripts as quickly as possible.

For further details on ActEd's marking services, please refer to the *2022 Student Brochure*, which is available from the ActEd website at www.ActEd.co.uk.

5.4 Feedback on the study material

ActEd is always pleased to receive feedback from students about any aspect of our study programmes. Please let us know if you have any specific comments (*eg* about certain sections of the notes or particular questions) or general suggestions about how we can improve the study material. We will incorporate as many of your suggestions as we can when we update the course material each year.

If you have any comments on this course, please send them by email to **CM1@bpp.com**.

The rate of interest earned on non-unit reserves is assumed to be 8% *pa*.

- (ii) (a) Calculate the reserves that are required at times $t = 1, \dots, 4$ in order to zeroise future negative cashflows. [6]
- (b) Calculate the net present value of the policy assuming that the company holds the non-unit reserves calculated in (i)(a). [6]
- (iii) Without carrying out any more calculations, explain the effect on the net present value if non-unit reserves earned interest at the rate of 10% *pa*. [2]
- [Total 12]

27.7 A special endowment policy pays a sum assured of £20,000 to a life who is currently aged exactly 57 after three years or at the end of the year of earlier death.

Exam style

Annual reversionary bonuses are declared at the end of each policy year, and an additional terminal bonus is payable at maturity only.

Policies may be surrendered only at the end of each policy year. On surrender, the policyholder receives a return of premiums with interest calculated at the rate of 3% per annum.

A level premium of £8,000 is paid at the start of each year.

The premium basis is as follows:

Interest:	7% per annum on cashflows and reserves	
Mortality:	AM92 Select	
Surrender rates:	15% of all policies in force at the end of year 1	
	5% of all policies in force at the end of year 2	
Reversionary bonuses:	6% per annum compound	
Terminal bonus:	10% of all other benefits payable at maturity	
Expenses:	Initial	£500
	Renewal	£30 at start of year 2
		£35 at start of year 3
	Termination	£100 per termination (death, surrender or maturity)
Reserves:	7,500 at the start of year 2 and 15,000 at the start of year 3 for each life in force.	

- (i) Calculate the profit signature for this policy according to the premium basis. [13]
- (ii) By accumulating the elements of the profit signature to the maturity date, explain briefly whether you think the company expects to declare the bonus rates it has assumed in its premium basis, assuming all the other assumptions in the basis are realistic. [2]
- [Total 15]

All study material produced by ActEd is copyright and is sold for the exclusive use of the purchaser. The copyright is owned by Institute and Faculty Education Limited, a subsidiary of the Institute and Faculty of Actuaries.

Unless prior authority is granted by ActEd, you may not hire out, lend, give out, sell, store or transmit electronically or photocopy any part of the study material.

You must take care of your study material to ensure that it is not used or copied by anybody else.

Legal action will be taken if these terms are infringed. In addition, we may seek to take disciplinary action through the profession or through your employer.

These conditions remain in force after you have finished using the course.

(ii)(b) **Net present value assuming non-unit reserves are set up**

The profit vector is the vector of non-unit cashflows after the reserves have been set up. So for this policy the profit vector is:

$$(-200, 13.80, 0, 0, 480) \quad [1/2]$$

The net present value is then:

$$-\frac{200}{1.1} + \frac{13.80 \times 0.896978}{1.1^2} + \frac{480 \times 0.716323}{1.1^5} = 41.91 \quad [1\frac{1}{2}]$$

[Total 6]

(iii) **If non-unit reserves earned 10% pa interest**

Holding reserves delays the emergence of profit. [1/2]

However, if the rate of interest earned on the reserves is 10%, then we are accumulating and discounting at the same rate. In this case, delaying the emergence of profit will have no effect on the net present value for the contract. [1]

So the net present value would be 42.56 as in (i). [1/2]

[Total 2]

27.7 (i) **Profit signature**

The calculations are shown in the following tables.

Year t	Premium (1)	Expenses (2)	Interest (3)	Mortality probability (4)	Death benefit + termination expenses (5)	Expected death cost (6)
1	8,000	-500	525.00	0.004171	20,100	-83.84
2	8,000	-30	557.90	0.006180	21,300	-131.63
3	8,000	-35	557.55	0.007140	22,572	-161.16

[3]

Year t	Dependent surrender probability (7)	Surrender value + terminat'n expenses (8)	Expected surrender cost (9)	Maturity value + terminat'n expenses (10)	Survival probability (11)	Expected maturity cost (12)
1	0.149374	8,340.00	-1,245.78	0	0.846455	0
2	0.049691	16,827.20	-836.16	0	0.944129	0
3	0	0	0	26,302.35	0.992860	-26,114.55

[6]

Year t	Cashflow (13)	Reserve at start of year (14)	Interest on reserve (15)	Expected cost of end yr reserve (16)	Profit vector (17)	Survival probability (18)
1	6,695.38	0	0	-6,348.41	346.97	1
2	7,560.11	7,500	525	-14,161.94	1,423.17	0.846455
3	-17,753.16	15,000	1,050	0	-1,703.17	0.799162

[3½]

Year t	Profit signature (19)
1	346.97
2	1,204.65
3	-1,361.11

[½]

Key to tables:

$$(3) = [(1) + (2)] \times 0.07 \text{ (as (2) is a deduction)}$$

$$(5)_t = 20,000(1.06)^{t-1} + 100$$

$$(6) = -(4) \times (5)$$

$$(7) = [1 - (4)] \times [\text{surrender probability}]$$

$$(8)_1 = 8,000 \times 1.03 + 100$$

$$(8)_2 = 8,000(1.03^2 + 1.03) + 100$$

$$(9) = -(7) \times (8)$$

$$(10)_3 = 20,000 \times 1.06^3 \times 1.1 + 100$$

$$(11) = 1 - (4) - (7)$$

$$(12) = -(10) \times (11)$$

$$(13) = (1) + (2) + (3) + (6) + (9) + (12)$$

Column (14) shows the reserve at time $t - 1$.

$$(15) = (14) \times 0.07$$

$$(16)_t = -(14)_{t+1} \times (11)_t$$

$$(17) = (13) + (14) + (15) + (16)$$

$$(18)_1 = 1$$

$$(18)_t = (18)_{t-1} \times (11)_{t-1}, \quad t > 1$$

$$(19) = (17) \times (18)$$

[Total 13]

(ii) ***Affordability of future bonuses***

Assuming 7% *pa* investment return, the first two years' cashflows accumulate to the following value at the end of Year 3:

$$346.97 \times 1.07^2 + 1,204.65 \times 1.07 = \text{£}1,686.22 \quad [1]$$

The outgo in the third year is £1,361.11. So the company can afford all the assumed bonuses during the policy with an additional profit of £325.11 at the end of the term. So, given these assumptions, it would be quite likely for the company to pay higher bonuses than these (though it depends upon how much profit is required for any shareholders). [1]

[Total 2]

All study material produced by ActEd is copyright and is sold for the exclusive use of the purchaser. The copyright is owned by Institute and Faculty Education Limited, a subsidiary of the Institute and Faculty of Actuaries.

Unless prior authority is granted by ActEd, you may not hire out, lend, give out, sell, store or transmit electronically or photocopy any part of the study material.

You must take care of your study material to ensure that it is not used or copied by anybody else.

Legal action will be taken if these terms are infringed. In addition, we may seek to take disciplinary action through the profession or through your employer.

These conditions remain in force after you have finished using the course.