Actuarial Society of India

November, 2005 Examination

Subject ST4 – Pensions and Other Employee Benefits

Indicative solution:
Note;

1 The solutions given are only indicative. It is realised that that there could be other points as valid answer.

2 Some of the questions ask "discuss", "describe" or some other form of answer as against only "list". The answer should therefore be in the form as required by the question. However indicative solutions contain only points and the student will secure marks for the points contained in the answer though will miss out some marks for not answering the question in the form as wanted.

1 A large company ABC Ltd has bought a small manufacturing company XYZ Ltd containing 2,000 employees. XYZ Ltd is to stay as a subsidiary of ABC Ltd. The finance director has asked you to advise on the type of pension benefits that should be established for the employees of XYZ Ltd.

(i) **List** further information that you will require from the finance director prior to making your recommendations. (8)

(ii) **Discuss** the relative risks of introducing a defined contributions scheme compared to a final salary arrangement from the point of view of

(1) the company; and (4)

(2) the employees. (2)

[**Total 14**]

Pension benefits for a subsidiary.

1 (i) List of further information from the FD.

1. What commitments, if any, were there with regards to future pension rights when the subsidiary was bought?
2. Does the employer want to provide any pension benefits?
3. What is employer's attitude to employees?
4. Paternalistic culture may make generous defined benefit more likely.
5. What benefits were employees previously entitled to?
6. What options do they have in relation to these past rights?
7. Can or would the company wish to treat employees of the subsidiary differently from ABC Ltd. employees?
8. Who are the company's competitors and what benefits do they provide?

9. Will this company need competitive pension benefits to attract and retain staff?
10. How much budget is available for pension benefits?
11. Would the FD prefer to target the budget towards any specific class or group of people?
12. Will employees be required to contribute?
13. What is FD's attitude to risk and potential variable costs in the future?
14. What is financial size of the company and turnover to gauge relative importance of pension arrangements?
15. What is future plan for company in terms of growth and acquisitions?
16. What is current and future age and salary profile likely to be?
17. Are there different classes to be treated differently e.g. would senior management require a separate arrangement?
18. How much, if any, resource is available for administration and how much involvement does the company want?
19. Are there unions who are likely to press for a certain type of arrangement.

a. (½ mark for each point. Maximum marks 8.)

(1) (ii) Relative risks of defined contribution and final salary arrangement.

The answer is expected as "discussion". Such answer should contain the following points;

Company's perspective:

(i) For DC scheme employer knows exactly what it will be contributing.

(ii) Financial risks are transferred to employee.

(iii) May not provide competitive benefits.

(iv) May not target contributions where employer wants to.

(v) If inappropriate DC investment choices made by employees, this may rebound on employer.

(vi) Significant employee education and support will be necessary to avoid future problems.

(vii) Final salary costs are unknown in advance and will vary with experience.

(viii) Legislation can introduce conditions that make final salary scheme become a financial burden on the employer.

(ix) Final salary schemes are likely to require more involvement in company administration time but can be more flexible in terms of the timing of any funding requirements, e.g. redundancy exercises.

a. (½ mark for each point. Maximum marks 4.)

Employees' perspective:

1. In a final salary scheme employee is likely to know in real terms the level of benefit they will receive.
2. Financial risk is with the employer.
3. Final salary scheme may be attractive in periods of high inflation or rapid promotion.
4. In a money purchase scheme employee benefits from good experience and suffers from bad experience e.g. investment returns, annuity rates
5. Employees may appreciate one type of arrangement more than other depending upon their understanding/knowledge of pensions.
6. Employees have more flexibility in the type of benefits they may take from a money purchase scheme.

b. (½ mark for each point. Maximum marks 2.)

2 You have just been appointed actuary to a long established defined benefit pension scheme where over 50% of the liabilities are represented by pensions in payment. You are about to undertake the first triennial valuation for the purpose of assessing the ongoing funding position.

(i) **Discuss** the validations that you would perform on the data for the valuation of the assets and the liabilities.(6)

(ii) **List** the assumptions that you may need to make in order to value the pensioners' liability. (4)

(iii) **(iii)** You have been instructed to undertake an analysis of the mortality experience of the pensioners over the last three years. **Outline** the steps and general principles which are involved in the analysis. (4)

(iv) **(iv) Discuss** the extent to which you would use the results of the analysis in part (iii) to select the assumption to be used for the triennial valuation of the pension scheme. (3)

[Total 17]

Valuation of a DB scheme

(i) Data Validation.

(i) Reconciliation of total number of members and changes in membership, using previous data and accounts.

(ii) Checks for existence of new members.

(iii) Comparison of average benefit levels or of average values of components of benefit calculation e.g. past service, salary etc with previous data and accounts.

(iv) Consistency between in-payment benefit levels indicated by membership data and corresponding figures in the accounts.

(v) Consistency between investment income implied by the asset data and the corresponding totals in the accounts.

(vi) Minimum and maximum levels of benefits, their components, ages etc.

(vii) Random spot checks on data for individual members.

(viii) Pensions in accounts tie in with pensions in valuation.

(ix) Comparison of scheme member totals and company employee totals.

(x) Comparison with other sources of data e.g. data for a group life scheme.

(xi) Employer-employee contributions, contribution rates, salaries consistent.

(xii) The value of the assets should be consistent with the investment managers' performance, contributions and outgo and previous value of assets.

a. (½ mark for each point. Total marks 6.)

(ii) Assumptions.

1. Mortality of pensioner - Use standard table.
2. Mortality of dependants/spouses/children - Use standard table but,
3. usual to ignore mortality of children and just use compound interest.
4. Age at which children's pension will cease. Probably latest age.
5. Rate of investment return depending on investment strategy.
6. Rate of pension increase.
7. Remarriage (if pension ceases/changes).
8. Proportion married or with dependants at death.
9. Age difference between pensioner and spouse.

(½ mark for each point. Maximum marks 4.)

(iii) The steps and general principles behind the analysis are as follows:

(1) Collect data for each age nearest and male and female separately.

(2) Calculate the exposed to risk at that age.

(3) Calculate the number of deaths at that age.

(4) Derive the relevant rates of mortality.

(5) In theory separate analysis will be carried out for mortality of members, dependants and orphans.

(6) If the scheme membership is small, then the amount of data is likely to be insufficient to produce a reliable statistic.

(7) The experience analysis may therefore be restricted to analysing the actual number of deaths versus the expected number based on membership data at the last actuarial valuation.

(8) Again, if the scheme is small, it will be important to exclude any unusual occurrences, eg multiple deaths due to a related incident.

(9) Subdivide by early/normal/late retirement.

(½ mark for each point. Maximum marks 4.)

(iv) Use of results of analysis for setting the mortality assumptions.

(1) For the very largest schemes, the analysis could help shape the mortality assumptions.

(2) This is more likely to be a scheme specific adjustment or blending of published tables rather than creating a new table from scratch.

(3) Most schemes, however, are not big enough for an analysis to be statistically meaningful and often data are incomplete.

(4) The purpose of the analysis would typically be to identify sources of surplus/deficit or to indicate broad adjustments needed to standard tables.

(5) For smaller schemes unlikely to do the analysis and would use standard tables.

(6) Don't want to overstate mortality or want to allow for future improvement in mortality.

(½ mark for each point. Total marks 3.)

3. A country has no previous history of pension provision by the State. The country has enjoyed recent rapid economic progress and the Government wants to establish a primary tier of State pension provision. You have been engaged to advise the Government on the matter. **List** the issues that you would raise in your report. **[10]**

Setting up a new primary tier of State pension provision

1. Eligibility e.g. residency test or occupational test
2. Funded or not; demographic factors/macroeconomics
3. Defined benefit or money purchase
4. If defined benefit, flat rate or earnings related?
5. Objective of pension - subsistence target?
6. Interaction with private provision/other state benefits
7. Potential to disincentivise existing private savings.
8. One pension age or a range

9. Increases to pension, flat, RPI or NAE? Should pensioners share in prosperity of country?
10. Include dependents benefits?
11. If money purchase, private or state-owned providers?
12. If money purchase, investment options and constraints
13. Investment mediums available and impact on Stock markets, Bonds etc.
14. State pension age/equalisation
15. Determination of contribution rates (for the member)
16. Cost to the government/sustainability
17. Ability to contract out; i.e. not to participate in State provision
18. Tax treatment
19. Possibility of cash commutation option
20. Means testing of ultimate benefit
21. Extent, if any, to which past service credits could be given
22. Ability to transfer to other State savings arrangements, or to non-state schemes
23. Ability to finance loans against accumulated capital value of benefits for specific purposes (e.g. property purchase)
24. How to communicate to people.

a. (½ mark for each point. Maximum marks 10.)

4. A large company has two separate pension schemes depending on the grades of the employees, a defined benefit pension scheme and a defined contribution scheme. **Describe briefly** how the possible benefit designs of each scheme could allow for early retirements. Your answer should include reference to any assumptions used to determine benefits and any other factors which may need to be considered. **[9]**

a) Early retirements for DB and DC schemes

1. The employer may attempt to be consistent in the treatment of early/late retirements across the two differing types of schemes. This can be difficult to achieve.
2. Alternatively it may be addressed elsewhere in the overall benefit package for individual employees.
3. Defined Benefit Schemes usually have fixed early retirement terms while defined contribution schemes are usually on a market basis reflecting market conditions at the date of retirement.

4. Need to ensure complies with Trust Deed and/or over-riding legislation
5. Is employer looking to encourage retirement, early retirements?

b. Defined benefit scheme

1. If the overall aim is actuarial neutrality then no explicit assumption is needed.
2. Otherwise an explicit early retirement assumptions e.g. x% retiring 1, 2, 3, ... years early.
3. Different considerations are likely for ill health early retirement - a more generous approach may be adopted. This will result in increased costs.
4. Employer/trustee consent is usually needed (to maintain control over costs)
5. The benefit design options include - making the benefit equivalent in value to the leaving service deferred pension.
6. Actuarial equivalent to the past service reserve on the funding basis or a more realistic basis.
7. Pragmatic scale e.g. accrued benefit reduced by say 4% p.a. for each year early.
8. Accrued benefit unreduced — this is likely to result in a funding strain unless explicitly funded for.

c. Defined contribution scheme

1. Generally, simply the accumulated fund for the individual.
2. Employer/trustee consent not usually needed.
3. The amount of pension will be a function of the size of fund and immediate annuity rates at the time of early retirement
4. Consideration will need to be given to the choice of investment funds as the member approaches the retirement e.g. switch to gilts and cash to protect capital.
5. It is possible to allow for enhanced benefits for ill health early retirement but these will need to be paid for at retirement.

(½ mark for each point. Total marks 9.)

5. An employer employing more than 10,000 employees, some in administrative jobs and others in field assignments has introduced employee benefits which interalia provide lump sum amount as a function of salary payable on death and Permanent

Total Disability. Suggestion has been made that the Employer should not take risk on its own, instead should approach a life insurer for a solution.

a. Describe the manner in which such lump sum benefit could be insured through a life insurer and if arranged, the financial impact such an insurance arrangement will have on the employer. (5)

(i) Group Life Insurance is most commonly used method to insure such lump sum benefits on death during service.

(ii) Insurers normally charge on annual recurrent single premium basis applying the premium rate to the total sum assured. However, some insurers apply a unit rate based on total sum at the beginning of the year, applying such unit rate to new entrants during the year.

(iii) The main attraction of group life insurance arrangement is that there is greater predictability in the cost of death benefits. In an un-insured arrangement there could be volatility in amount and time of death benefits, particularly for small employers.

(iv) However, in the long term the insurer need to charge for its expenses and profit margin besides the cost of benefits.

(v) Small employers also use group insurance arrangement to protect against liquidity risk.

(vi) Very large employers may also use Stop-loss or Catastrophe insurance

[1 mark for each point with maximum of 5 marks]

b. Describe how experience rating or profit sharing arrangements could form part of such an insurance arrangement, while explaining the difference between the two. (5)

Experience Rating/Profit Sharing;

For large schemes insurers try to produce a more accurate premium rate by taking account of the actual mortality experience of the scheme being insured.

[1 mark]

This is done in two ways;

Experience rating: This approach is based upon using schemes past mortality experience and deciding whether it is appropriate to adjust the unit rate up or down from that derived using standard rates of mortality. **[2 marks]**

Profit sharing: Under this approach the Insurer will take in to account of the scheme's actual mortality experience during a year of insurance cover. A scheme with low claims could receive a year end premium refund whereas higher premium may be required in the opposite case. **[2 marks]**

c. Explain the concept of "free cover limit" and the conditions under which such limit could be as high as possible. **(5)**

Free Cover Limit (FCL) is the amount up to which the insurer will provide cover for individuals in the group without medical evidence, and it is usually expressed as a maximum per individual. **[3 marks]**

The FCL could be made high by;

(i) Making the insured group large by say ensuring that all the employees join the scheme**.[1 mark]**

(ii) If the employees are medically tested for fitness at the time of joining service and/or at regular intervals then the insurer may be inclined to give higher FCL than otherwise**.[1 mark]**

6. An employer employing about 10,000 employees broadly of the same occupational risk profile, wanting to set up a DB pension scheme has been requested by the employees to provide a number of options as part of the scheme benefits. Describe the risk associated with the following options and mention the manner in which such risks could be minimised or eliminated;

a. Options that may be granted in relation to retirement benefits available on events other than Normal Retirement. **(5)**

The following options are normally available; **(3 marks)**

(i) A transfer to another scheme.

(ii) Early receipt of benefits

(iii) Late receipt of the benefits

(iv) Conversion from pension to cash or vice-versa.

(v) Transfer of benefits from one beneficiary to another.

The risk associated with the option/s is financial in nature that there may be different costs associated with different options and such options may then be exercised at a time and in a manner that causes maximum cost to the Sponsor of the Scheme. **(1 mark)**

Way to eliminate or minimise the risk in options is that the alternative benefits can be determined by setting up an equation of value. The value of different benefits is set equal on a given set of assumptions. **(1 mark)**

b. Transfer of benefits through transfer values to another scheme. (5)

The risk associated with transfer to the Settler is that the value of assets transferred may exceed the amount of liabilities related to the benefits in the current scheme at the transfer date. If this happens then either the security of the benefits to remaining members gets compromised or cost to the settler increases. **(3 marks)**

Since the transfer of benefits involves physical transfer of assets to the receiving scheme, it is usual to calculate the transfer value with regard to prevailing market

conditions. This reduces the opportunity for members to select against the scheme as markets rise and fall. **(2 marks)**

c. Early retirement benefits. (5)

The Early Retirement results in to payment of benefits over a longer period, though probably at a smaller amount. The early retirement thus has the financial risk of paying out more than the amount of liability corresponding to the value of benefits held at the point of early retirement. **(1 mark)**

The value of benefits will depend upon the manner in which the benefits are opted and assumptions to determine the same are chosen accordingly. For example;

(i) The retiree may remain a member of the scheme until the benefits become due normally.

(ii) The retiree remains a member without further accrual of benefits.

(iii) The retiree ceases being a member immediately.

(3 marks)

The risk of selection is avoided by making the option available only at the consent of scheme managers, Trustees or the Employer. And the consent is given after ensuring that no anti-selection takes place**. (1 mark)**

7. An employer having a large number of employees, all broadly of same homogeneous risk profile, wants to establish a DB pension scheme providing lump sum death benefits besides pension. The employer desires to administer its own fund for providing such benefits and has approached you as an actuary to advise on the funding issues. Answer the following questions in this context;

a. List the criteria that may be set to assess a funding methodology (4).

Funding strategy/methodology may be influenced by the need to have a generally stable contribution or a contribution that varies to meet other funding objectives**.(1 mark)**

The criteria that may be set to determine funding strategy/methodology are;

1. Security of employee benefits
2. Stability of contribution
3. Durability of contribution
4. Realism to accommodate cash flow/taxation issues
5. Liquidity – availability of funds to meet benefit payout
6. Opportunity cost in relation to deployment of resources in the Enterprises business.
7. Flexibility in the timing and amount of contribution

(1/2 mark for each point with a maximum of 3 marks)

b. List and categorise, describing briefly the main funding methods (5).

The following funding methods are commonly used;

1. Attained age funding method
2. Entry age funding method
3. Projected Unit funding method
4. Current Unit funding method

(1 mark for each point with a maximum of 3 marks)

The first two are categorised as **Prospective Method** which target a stable contribution rate and the latter two are categorised as **Accrued Benefits Methods** which fund for a target level of accrued benefits. **(1 kark)**

Under Prospective Methods the accrued liability is the difference between the discounted value of total expected benefits and the discounted value of the future contribution. **(1/2 mark)**

Under Accrued Benefits Methods models are used that target a standard level of contribution to be adjusted as experience is studied against assumptions made. **(1/2 mark)**

c. Set out the general formula for Standard Contribution Rate defining the symbols used. (5)

The generalised formula for Standard Contribution Rate (SCR) assuming current age as x years and normal retirement age 65 years;

$$\{f*Y*S*r_{65}\ /l_x\ (1+r)^{65-x-Y}\ (1+e)^{Y}\ *v^{65-x}\ a^{r}_{\ 65} + AL\ \{[(1+e)^{Y} - (1+r)^{Y}]/(1+r)^{Y}\}\}/S*a_{\ [y]}^{(i-e)}$$

where ;

f = pension accrual factor

Y = number of years of service to be included in the calculation

S = current salary

r = inflationary growth in the pens ion (other han salary growth)

e = inflationary growth of the pension (due to salary growth)

$a_{[y]}$ is an annuity payable for a limited period starting at age Y which is subject to all the inforce decrements applicable for the active members.

All other symbols have standard meanings.

(3 marks for the formula and 2 marks for the symbol definitions)

d. Set out in a tabular form comparison of the main factors affecting the Standard Contribution Rate under various funding methods; **(6)**

Comparison of factors affecting Standard Contribution Rates (1.50 marks for each row correctness);

	Entry Age	**Attained Age**	**Current Unit**	**Projected Unit**
Age	Entry age	Average age	Average age	Average age
Future Service	All future years	All future years	Control period	Control period
Benefits Revaluation	Salary projected	Salary projected	Early leaver revaluation	Salary projected
Past Service	No	NO	Salary revaluation to the AL	No