

Manufacturing Engineering Tripos Part 1

3P8 Exam Crib 2010

SECTION A Financial Accounting

1 (a) The net book value of non-current assets is reported as £2,562,500. This is after deduction of the accumulated depreciation of £1,475,400. Thus the cost of the non-current assets is £4,037,900 (£2,562,500 + £1,475,400). Depreciation on the straight-line basis means that the 20% rate is applied to the cost. Depreciation is therefore £807,580.

(b) A provision is required when a past event gives rise to a reasonable certainty that a transfer of economic benefits will occur, but either the amount which will be transferred or the timing of the transfer is uncertain. In this case, Trevor has accepted liability, and there is reasonable certainty that an outflow will be required although Trevor does not agree that this should be £750,000. Based on legal advice, the amount (£45,000) can be estimated with reasonable accuracy, but there is less clarity about when the transfer will take place.

(A contingent liability arises when there is less certainty about either the value of economic benefits which will be transferred or whether a transfer of economic benefits will be required at all. The lack of certainty is because the obligation to transfer economic benefits will be determined in the future by events which the firm is not able to control.)

(c) Earnings are given by:

Retained profit	£689,424
+ Ordinary dividend	<u>£65,000</u>
	<u>£754,424</u>

Number of shares = $65,000 \times 10 = 650,000$

Thus EPS = $(754,424 \times 100) \div 650,000 = 116 \text{ p}$

(d) Garnsey has purchased enough to have significant influence, particularly with a board member, but not enough for control. Therefore, Heffernan will be an associate company of Garnsey Co. The correct treatment is the equity method with the share of profits shown in the income statement and the share of capital and reserves shown on the balance sheet.

(e) (i)
Morgan Ltd
Cash Flow Statement for the year ended 31 May 2009

	£	
Net cash inflow from operating activities	311,576	(note 1)
Servicing of finance	(17,180)	(working 3)
Taxation	(40,350)	(working 4)
Capital expenditure	<u>(182,000)</u>	(working 5)
Net Cash Flow before financing	72,046	
Financing	<u>140,000</u>	(working 6)
Increase in cash	<u>212,046</u>	

Note 1

Reconciliation of operating profit to net cash flow from operating activities

	£	
Operating profit	203,720	(working 1)
Depreciation	127,480	(from question)
Decrease in stocks	17,728	(working 2)
Increase in debtors	(45,690)	(working 2)
Increase in creditors	<u>8,338</u>	(working 2)
Net cash inflow from operating activities	<u>311,576</u>	

Working 1

Operating Profit

	£	
Retained profit 2009	431,119	
Retained profit 2008	<u>290,799</u>	
thus Retained profit for year	140,320	
Add Interest charge	17,800	(working 3)
Taxation charge	<u>45,600</u>	(working 4)
	203,720	

Working 2

Working Capital

	2009 £	2008 £	Change £	
Stock	162,832	180,560	17,728	(decrease,inflow)
Debtors	241,580	195,890	45,690	(increase,outflow)
Creditors	136,907	128,569	8,338	(increase,inflow)

Working 3

Interest paid

	£
Opening creditor	6,800
Profit and loss charge	<u>17,800</u>
	24,600
Closing creditor	<u>7,420</u>
= Amount paid	17,180

Working 4

Taxation

	£
Opening creditor	23,400
Profit and loss charge	<u>45,600</u>
	69,000
Closing creditor	<u>28,650</u>
= Amount paid	<u>40,350</u>

Working 5

Capital expenditure

£

NBV b/f 1,486,200

Profit and loss charge (127,480)

1,358,720

NBV c/f 1,540,720

= Amount paid 182,000 = Additions

Working 6

Financing £

Increase in short term loans 11,000

Increase in long term loans 129,000

140,000

(ii) The most significant issues which are apparent from the cash flow statement are:

- The company has been successful in generating cash from its operating activities.
- There is evidence of continued investment in fixed assets, which should provide a basis for continued growth in the future.
- There is evidence of good financial management as much of the cash outflow for capital expenditure was raised by taking out a new loan.

- The company has remained profitable and has also reduced stock levels, which suggests good management of working capital.
- There has been an increase in the level of debtors, which may indicate problems in credit control.

Following from these observations, it would be appropriate to obtain more information on the following matters:

- Exactly what type of fixed assets were acquired, and how are these assets expected to contribute to future profitability and growth?
- Why was such a significant loan raised when the company was generating cash from its operating activities?
- What are the directors' plans for the future expansion, and how much funding will these plans require?
- What is the reason for the reduction in stock levels? Was this a result of a deliberate policy, or has the stock been artificially reduced for some reason?
- What is the company's policy on working capital management?
- Has there been any significant change in the working capital cycle?
- Over what period are the loans due to be repaid?
- How does the loan repayment term relate to the useful life of the fixed assets?

A popular question, well answered in general. Most marks were dropped in Parts (a) to (d) (but not consistently) and (e) in the treatment of financing and cash flow from operations.

2 (a) This is not a realised gain and will not go through the income statement. Instead it will be shown as an increase in non current assets and in the (revaluation) reserves. It will also be shown in the statement of recognised gains and losses.

(b) Cash generated by operating activities is calculated by adding the depreciation charge to the operating profit before interest and taxation, and adjusting for the net movement in inventory, receivables and payables. In this case, as the net value has reduced, this is a cash inflow. Thus the cash generated by operating activities is:

	£
Retained profit	1,856,954
Depreciation	165,700
Taxation	572,855
Interest	211,744
Net movement	<u>27,965</u>
	<u>2,835,218</u>

(c) Net book value of assets	£1,728,500
Tax written down value	<u>£1,407,200</u>
Accelerated capital allowances	£321,300
Deferred tax liability at 23%	£73,899
Balance brought forward	<u>£75,720</u>
Movement	<u>£1,821</u>

(as balance has reduced, this will give rise to a credit entry in the income statement)

(d) Dividend per share = EPS x Dividend payout ratio
 = £0.60 x 20%
 = £0.12
 Share price = DPS/Dividend yield
 = £0.12/0.04
 = £3.00
 Price/earnings ratio = Share price/EPS
 = £3.00/0.60
 = 5 times

or

$$\text{Price/earnings ratio} = \text{Dividend payout ratio} / \text{Dividend yield}$$

(e) (i) Goodwill on acquisition

Net assets of Shaw at date of acquisition	£750,000
x 30% = Net assets acquired	£225,000
Cost of shares	£290,000
Goodwill on acquisition	£65,000

(ii) Amortised over five years

$$\text{Thus annual amortisation} = £65,000 \div 5 = £13,000$$

$$\text{Thus unamortised at 30 November 2005} = £52,000$$

(iii)

1. In the financial statements of Gregory plc:

Fixed assets will include a long term investment at the cost of £290,000. It is permissible to value the investment at market value, so the carrying value may be increased in the future. It should be noted, however, that whilst reflecting an increase in value is a matter of choice, any fall in value below cost must be reflected in the carrying value.

2. In the consolidated financial statements:

The equity method of consolidation should be used. This is sometimes known as the 'one line' method. This term is used as the value of the net assets in the associated company is reported on a single line on the balance sheet. The value of the other assets and liabilities is not affected. The value shown is the group share of the net assets, plus the unamortised goodwill. Capital and reserves will be increased by the inclusion in the profit and loss account of the group share of the retained profit of the associated company, less the goodwill amortised to date.

Therefore the balance sheet will include the following items:

Investment in Associated undertaking	£301,000
as the cost of the investment	£290,000
will be cancelled out,	
the net increase will be	£11,000

The profit and loss account will also be increased by £11,000

Workings:

Investment in Associate:

Net assets at date of acquisition	£750,000
Estimated Profit	<u>£80,000</u>
Estimated net assets 30.11.05	£830,000
Group share (30%)	£249,000
Unamortised goodwill	<u>£52,000</u>
Balance Sheet value	<u>£301,000</u>

Profit and Loss Account:

Retained profit for year	£80,000
Group share (30%)	£24,000
less Goodwill amortised	<u>£13,000</u>
Balance sheet value	£11,000

(iv) If the investment gave rise to control, the accounting treatment would differ as follows:

- the investee would be a subsidiary undertaking
- consolidation accounting would be used
- this would mean that on the consolidated balance sheet:
 - the value reported for each asset and liability would be the total of the value of that asset or liability for the investing company and the investee
 - unamortised goodwill would be reported as a specific asset
 - as the total value of the net assets of the investee are consolidated, it is necessary to report the extent to which the net assets are controlled outside the group. This is done by including the value of minority interest as part of the consolidated capital and reserves.

There was a wide variation in the marks for the 30 marks available for sections (a) to (d). Only a few answers handled the treatment of goodwill in part (e)(iii).

SECTION B Management Accounting

3 (a) In order to maximise short term profit, the scarce resource (material A) should be utilised in order to maximise the contribution per kg.

The contribution per unit produced is:

Bing £14

Dong £15

The contribution per kg of material A is:

Bing £4

Dong £3

Thus production of Bing is preferred. There is only sufficient material A to satisfy the market demand for Bing so no production of Dong should be undertaken. Therefore, 10,000 of Bing and none of Dong.

(b) EVA = Net operating profit after tax (NOPAT) less capital charge

Net operating profit after tax:

Operating profit	£6·380m	
– Tax	£1·460m	
		= £4·920m

Capital charge:

Economic value of assets	£31·70m	
x Cost of capital 15%		= £4·755m

Thus EVA = £0·165m

(c) Operating profit	£586,900	
Imputed interest	<u>£359,772</u>	(£2,569,800 x 14%)
Residual income	£227,128	

(d) (i) Calculation of product costs using ABC:

Product	A	B	C	
	£	£	£	
Direct material per unit	55·00	67·00	98·00	
Direct labour per unit	41·00	54·00	57·00	
Overheads per unit:				
Machine costs	43·64	109·11	43·64	(W1)
Set up costs	45·58	85·46	106·83	(W2)
Material handling	<u>25·38</u>	<u>9·52</u>	<u>152·31</u>	(W3)
Total cost per unit	210·60	325·09	457·78	

Working 1

Machine costs

Product	A	B	C	Total
Machine hours per unit 0.6 1.5 0.6				
Budgeted production volume	600 units	400 units	200 units	
Total machine hours	360	600	120	= 1,080
Machine costs				£78,560
Cost per machine hour				£72.74
Cost per unit	43.64	109.11	43.64	

Working 2

Set up costs

Product	A	B	C	Total
Production runs in period	32	40	25	97
Set up costs				£82,900
Cost per set up				£854.64 (= 82900 / 97)
Cost per unit	45.58	85.46	106.83	

The cost per unit is calculated as follows:

(£854.64 x production runs per product) ÷ production volume

Working 3

Material handling cost

Product	A	B	C	Total
Material deliveries	8	2	16	26
Material handling costs				£49,500
Cost per delivery				£1,903.85 (= 49599 / 26)
Cost per unit	25.38	9.52	152.31	

The cost per unit is calculated as follows:

(£1,903.85 x material deliveries per product) ÷ production volume

(ii)

The calculated the cost per unit for each of the products can be compared with the selling price as follows:

	A	B	C
	£	£	£
Selling price per unit	300.00	530.00	435.00
Cost per unit	210.60	325.09	457.78
Profit/(Loss) per unit 1	89.40	204.91	(22.78)

From this it can be clearly seen that production of Product C should cease, as this product is unprofitable. At first sight, product B appears to be the most attractive, yielding a unit profit of over £200. This seems to suggest that we should maximise our production of product B. However, such an approach ignores the fact that machine hours are limited to 1,140 in each production period. This means that an assessment of which product is more favourable should be based on the profit per unit of limiting factor, rather than the profit per unit of output.

Carrying out such a calculation, we can see:

Product A	B	
Profit per unit	£89·40	£204·91
Machine hours per unit	0·6	1·5
Profit per machine hour	£148·98	£136·61

This means that Product A is preferable, and should be produced up to the maximum market demand. Product B should be produced only when demand for Product A is satisfied.

(iii) Other factors

Before implementing my recommendation to cease production of Products C and B, the following factors should be considered:

- Sales of each product may be interdependent. If sales of Product A can only be made along with sales of C in particular, it would obviously be counter-productive to cease sales of C.
- The interdependence of products from Harcamlow with products of other sites would also need to be considered.
- Cessation of a product, even if it is independent of the other products produced may result in a loss of customer goodwill, and sales could be adversely affected.
- Market demand should be confirmed to ensure that there are no factors which will lead to reduced sales volumes.
- The stage of each product in the product life cycle may affect the decision. If A is a mature product, there may be a declining market. Concentrating production on a mature product may mean that we are relying on a market which could soon disappear.
- It would also be prudent to review current practices to assess whether the cost structure of products B and C can be amended, leading to a reduction in unit cost.
- The accuracy of the results of activity based costing is entirely dependent on the use of appropriate cost drivers. If the cost drivers selected do not actually influence the total cost incurred, we will be making decisions based on inaccurate information. It is therefore essential that we are confident that the cost drivers have been correctly identified.
- It should also be noted that the analysis of costs in activity based costing assumes that all costs are amenable to control over the long term. If we are merely seeking to maximise short term profit, activity based costing is not an appropriate technique.

This question was generally tackled well, with two notable exceptions.

4 (a) Recruitment of untrained staff will reduce the efficiency of the workforce, leading to an adverse labour efficiency variance. Also, the need to buy specialised materials from a new supplier at short notice is likely to mean that there will be no opportunity to negotiate a keen price or a bulk discount, giving an adverse materials price variance.

(b)	Capital employed before project	£2,680,000
	Current profit (ROI of 15.5%)	£415,400
	Profit from project	£53,000
	Profit including project	£468,400
	Investment in project	£320,000
	Capital employed after project	£3,000,000
	Imputed cost of capital at 13%	£390,000
	Thus Residual Income	£78,400

(c) Standard output:

11 staff x 30 productive hours per week x 4 weeks x 2 per hour = 2,640
Actual output 2,850 queries resolved.

Variance 210

As the actual output is greater than standard, this is a favourable variance

Standard cost per question is £11.38 per query

Variance of 210 queries at £11.38 = £2,389.80F

(d) (i) Incremental cash flows are as follows:

Year	0	1	2	3	4
	£000	£000	£000	£000	£000
Gross profit		65	60	50	35
Machinery	(70)			10	
Working capital	(20)			20	
Variable overheads		(27)	(30)	(24)	(18)
Fixed overheads		(5)	(5)	(5)	(5)
Cash flows	(90)	33	25	21	42

(ii) Using a 10 per cent discount rate:

Year	0	1	2	3	4
	£000	£000	£000	£000	£000
Cash flows	(90)	33	25	21	42
Discount rate 10%	1.00	0.91	0.83	0.75	0.68
Discount cash flows	(90)	30.0	20.8	15.8	28.6

Net present value = 5.2

The NPV is positive and so a higher discount rate is required. Try 14 per cent:

Year	0	1	2	3	4
	£000	£000	£000	£000	£000
Cash flows	(90)	33	25	21	42
Discount rate 10%	1.00	0.88	0.77	0.68	0.59
Discount cash flows	(90)	29.0	19.3	14.3	24.8

Net present value = - 2.6

The approximate internal rate of return is $10\% + 4\%[5.2/(5.2 + 2.6)] = 12.7\%$

(iii) The expected internal rate of return exceeds the cost of capital. This means that, by accepting the project, the wealth of the shareholders is expected to increase. Thus, the product should be launched.

(iv) The internal rate of return (IRR) method of investment appraisal has a number of strengths. It takes into account all relevant cash inflows and outflows relating to the project and recognises both the time value of money and the risks involved in the project through the discounting process.

It provides a clear decision rule concerning acceptance or rejection of a proposal and the expression of the final result in terms of a percentage seems to find favour among managers.

However, where unconventional cash flows arise from a project, the IRR method can lead to multiple rates of return being calculated.

Furthermore, when prioritising projects the IRR method may not deal adequately with differences in scale between competing projects. To maximise the wealth of shareholders, it is the absolute return rather than the relative return (as expressed by the IRR) that is important.

Therefore, the NPV approach is superior.

This question was tackled by only three candidates and was done rather poorly.

Manufacturing Engineering Tripos Part 1

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SECTION C Industrial Economics

5 (a)

$$\pi_1 = (1500 - 0.2X_1 - 0.2X_2) \cdot X_1 - 40000 - 200X_1 - X_1^2$$
$$d\pi_1/dX_1 = 1300 - 0.2X_2 - 2.4X_1 = 0$$

Or

$$\begin{aligned} X_1 &= 500^{2/3} - 1/12 X_2 && \text{Firm 1's reaction function} \\ X_2 &= 6500 - 12X_1 \end{aligned}$$
$$\pi_2 = (1500 - 0.2X_1 - 0.2X_2) \cdot X_2 - 80000 - 400X_2 - 0.8X_2^2$$
$$d\pi_2/dX_2 = 1100 - 0.2X_1 - 2X_2 = 0$$
$$X_2 = 550 - 0.1X_1 \quad \text{Firm 2's reaction function}$$

Therefore,

$$\begin{aligned} 550 - 0.1X_1 &= 6500 - 12X_1 \\ 11.9X_1 &= 5950 \\ X_1 &= 500 \\ X_2 &= 500 \\ P &= 1500 - 0.2X = 1300 \end{aligned}$$
$$\begin{aligned} \pi_1 &= 500 \times 1300 - 40000 - 200 \times 500 - 500 \times 500 \\ &= 260000 \end{aligned}$$
$$\begin{aligned} \pi_2 &= 500 \times 1300 - 80000 - 400 \times 500 - 0.8 \times 500 \times 500 \\ &= 170000 \end{aligned}

(b)

$$\pi_1 = 1000X_1 - 40000 - 200X_1 - X_1^2$$
$$d\pi_1/dX_1 = 800 - 2X_1 = 0$$
$$X_1 = 400$$
$$\pi_2 = 1000X_2 - 80000 - 400X_2 - 0.8X_2^2$$
$$d\pi_2/dX_2 = 600 - 1.6X_2 = 0$$
$$X_2 = 375$$
$$\begin{aligned} \pi_1 &= 400 \times 1000 - 40000 - 200 \times 400 - 400 \times 400 \\ &= 120000 \end{aligned}$$
$$\begin{aligned} \pi_2 &= 375 \times 1000 - 80000 - 400 \times 375 - 0.8 \times 375 \times 375 \\ &= 32500 \end{aligned}$$$$

$$(c) \quad X = X_1 + X_2 = 400 + 375 = 775$$

$$P = 1500 - 0.2 \times 775 = 1345$$

$$(d) \quad TR = (1500 - 0.2X).X$$

$$MR = 1500 - 0.4X = 1500 - 0.4(X_1 + X_2)$$

$$MC_1 = 200 + 2X_1$$

$$MC_2 = 400 + 1.6X_2$$

$$MC_1 = MC_2$$

$$2X_1 = 200 + 1.6X_2$$

$$X_1 = 100 + 0.8X_2$$

$$MC_2 = MR$$

$$400 + 1.6X_2 = 1500 - 0.4(X_1 + X_2)$$

$$400 + 1.6X_2 = 1500 - 0.4(100 + 0.8X_2 + X_2)$$

$$2.32 X_2 = 1060$$

$$X_2 = 456.9$$

$$X_1 = 100 + 0.8X_2 = 465.5$$

$$P = 1500 - 0.2 \times 922.4 = 1315.5$$

$$\pi = 1315.5 \times (456.9 + 465.5) - 40000 - [(200 + 465.5) \times 465.5] \\ - 80000 - [(400 + \{456.9 \times 0.8\}) \times 456.9]$$

$$\pi = 433860$$

(e) Discuss:

- Inadequacy of the Cournot model assumptions
- Difficulties of price regulation and why it works for utilities but not for goods
- Similarity of the Cournot and monopoly outcomes
- Loss of consumer surplus.

Good overall. The main problems were with the later parts of the question.

6 (a) Drawbacks of multiplant operations could be discussed in terms of the loss of production economies of scale due to smaller plant sizes, the potential problems of plant-level rivalry contrary to the interests of the whole firm, and the coordination and communication problems that might result. In relation to the former it is worth noting that for only a few industries do plant-level economies of scale make mes large in relation to the whole market (but such industries do exist). In relation to the latter drawbacks: the growth of the multi-divisional form and the explosion of modern communications have reduced these problems considerably. Finally, it is important to establish appropriate divisional incentives to ensure that actions are taken for the benefit of the whole firm.

Potential benefits of multiplant operations include:

- Avoid the adverse consequences (labour problems, control loss, bureaucracy) of large plants but still benefiting from pecuniary economies of scale and market power.
- Reduction of transport costs by siting plants closer to markets.
- Gives the ability to add to capacity in manageable amounts avoiding too much excess capacity.
- Permits plant specialisation and efficiency gains.
- Easier to manage variations in demand without incurring sharp rises in average fixed costs.
- A problem in one plant may be compensated for by extra production in other plants.

(b) A good answer will discuss the various sources of barriers to entry including economies of scale, product differentiation and others (eg control of technology, location, distribution, supplies). It should also explain how these create barriers to entry.

However, the statement needs to be critically evaluated, possibly by reference to the other forces that Porter has characterised as determining industry competition (eg threats from customers, suppliers, and substitute products).

In addition, the role of free trade and imports should be discussed.

The discussion of multiplant activity was weaker than the barriers to entry discussion but there were some excellent answers.

SECTION D Strategy and Governance

7 The answer should begin by discussing the so-called agency problem created by the growth of large businesses and the separation of ownership from control.

It might then address the market for corporate control, possibly in the context of the Marris managerial model. In this model, the threat of takeover is the ultimate constraint on the management team. The answer may then discuss the rather weak evidence for this and the rather stronger evidence that mergers may be the mechanism through which managers abuse their position.

A good answer will explore the alternative means by which the agency problem may be tackled through stronger governance regimes, shareholder activism and the role of the outside directors. Finally, there should be some discussion of the way in which the remuneration packages of top managers have been changed over time in an attempt to make the actions of management consistent with shareholder interests.

The weakness in some answers was that most candidates failed to contextualise the key points they wanted to make.

8 The answer could usefully be divided into a number of parts. The first part should describe the Product Life Cycle in terms of its four (five) stages: (development); introduction; growth; maturity; and decline. The length of the life cycle varies substantially between product groups. The answer should stress that marketing objectives will change over the life cycle: (alpha/beta testing); create product awareness; maximise market share; defend profitability and market share; and reposition, or drop. Some may relate the model to the BCG matrix.

The second part can then put the Consumer Adoption Curve in the context of the life cycle model taking as its starting point the traditional S-curve model. The various stages can be characterised as: early adopters/pioneers; early majority/pragmatists; late majority/conservatives; and laggards. A good answer may make use of Roger's ACCORD model and the influential paper 'Crossing the Chasm' by Moore.

The other parts of the answer may take each stage in turn, or look separately at pricing, promotion and distribution through the various stages. Pricing might move from skimming to penetration in the early stages with some discussion of how to capture the early majority. In the mature stage the importance of oligopolistic pricing and non-price competition could be discussed. Promotion initially is concerned with raising product awareness, but may need to target specific markets in order to capture the majority. From there promotion is about extension into other markets building on existing success in the target market. In the mature phase promotion is associated with brand strength and customer loyalty. Distribution starts selectively and builds links with distributors in the target markets and offers the high margins. During the growth phase the range of distributors may increase and their margins lower. In the decline the number of distribution channels will decline.

Popular question, covered most recently by the lecture material, but few gave comprehensive answers.