MET2
MANUFACTURING ENGINEERING TRIPOS PART IIA - 2018
Paper 5 Answer Sheet
Section A
1. **BELVEDERE**
(a)
Profit and Loss Account for the year ended 31 December 2015

	£
Revenue (£450,000-£1,000 (W1))	449,000
Cost of sales (W2)	(210,000)
Gross profit	239,000
Administrative expenses (W3)	(162,500)
Distribution costs	(56,000)
Operating profit	20,500
Finance costs (£50,000 x 8% x 3/12)	(1,000)
Profit for the year	19,500

(b)
Balance Sheet as at 31 December 2015

	£
Non-current assets	
Property, plant and equipment (£150,000-£30,000-£24,000 (W2))	96,000
Current assets	
Inventories	27,000
Receivables (W4)	30,000
Cash and cash equivalents	5,000
Total assets	158,000
Equity	
Ordinary share capital	10,000
Retained earnings (£25,500+£19,500 (P/L))	45,000
Non-current liabilities	
8% Loan	50,000
Current liabilities	
Trade and other payables (£32,000+£1,000 loan interest)	33,000
Provision	20,000
	158,000

Workings:

(W1) Sales Return

A sales return has not been accounted for. The correcting entry is:

Dr Revenue	£1,000
Cr Receivables	£1,000 (W4)

(W2) Cost of Sales

	£
Opening Inventory	33,000
Purchases	180,000
Depreciation ((£150,000-£30,000) x 20%)	24,000
Closing inventory	(27,000)
	210,000

(W3) Administrative Expenses

	£
Per trial balance	140,000
Irrecoverable debt (W4)	1,500
Increase in allowance for receivables (W4)	1,000
Provision – defective goods claim	20,000
	162,500

(W4) Receivables	£
Per trial balance	36,000
Allowance per trial balance	(2,500)
Increase in allowance for required (W3)	(1,000)
Irrecoverable debt (W3)	(1,500)
Sales return (W1)	(1,000)
	30,000

(c) Inventories are assets that are held for sale in the ordinary course of business; in the process of production for such sale; or in the form of materials or supplies to be consumed in the production process or in the rendering of services.

Inventories shall be measured at the lower of cost and net realisable value (NRV). Net realisable value is the estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale.

In inventory costing, the First in, first out (FIFO) method – assumes that the earliest inventories are sold first. In the Weighted average cost (AVCO) method – cost of the inventory is

recalculated with weights that are based on the quantities of each batch of inventories purchases and the remaining quantities of the previous batch still in the inventory.

In an environment if rising prices, the FIFO method will show the highest profits initially compared to AVCO. And correspondingly, the FIFO method will have the higher value of closing inventory compared to AVCO. The results will be reversed in an environment of falling prices. However, over the life-cycle of the business, the total profits will be the same whichever method of inventory valuation is adopted.

Examiner's comments:

The candidates were good in answering parts (c). Part (a) and (b) was less well answered. On average the answers to part (a) and (b) was reasonably satisfactory but with more variation in terms of quality. In particular, students found it difficult to calculate the cost of goods sold as well as the treatment of depreciation in the cost of goods sold. Some students could not make the balance sheet to balance in part (b).

2. **HIRU**

Statement of cash flows for the year ended 30 June 2015

	£'000	£'000
Cash flows from operating activities		
Profit before tax	31,000	
Adjustments for:		
Depreciation charge	15,000	
Loss on sale of plant and equipment	2,000	
Interest payable	750	
Increase in inventory (£36,000-£30,000)	(6,000)	
Increase in trade receivables (£40,000-£35,000)	(5,000)	
Increase in trade payables (£36,500-£30,000)	6,500	
Cash generated from operations	44,250	
Interest paid	(750)	
		43,500
Cash flow from investing activities		
Cash purchase of property, plant and equipment (W1)	(40,000)	
Disposal proceeds of plant and equipment (W2)	8,000	
		(32,000)
Cash flows from financing activities		
Repayment of bank loan (W3)	(10,000)	
Proceeds of share issue (£5,000+£5,000) (W4)	10,000	
Dividends paid (W5)	(14,000)	
		(14,000)
		(2,500)
Cash and cash equivalents b/fwd		10,000
Cash and cash equivalents c/fwd		7,500

(W1) PPE additions in the year

	£'000
PPE CV bal b/fwd	93,000
Less: CV of disposals (£8,000+£2,000 loss)	(10,000)
Less: depreciation charge	**(15,000)**
Revaluation	2,000
Cash paid for PPE additions	**40,000**
PPE CV bal c/fwd	110,000

(W2) Loss on disposal of plant and equipment

	£'000
PPE CV of disposal (£8,000+£2,000)	10,000
Add: Loss on disposal in cost of sales	(2,000)
Disposal proceeds received	**8,000**

(W3) Bank Loan – amount repaid

	£'000
Bank Loan b/fwd	17,000
Cash received – additional loan finance	**10,000**
Bank Loan c/fwd	7,000

(W4) Issues of shares in the year

Share Capital	£'000
Balance b/fwd	15,000
Proceeds of share issue in the year	**5,000**
Balance c/fwd	20,000

Share Premium	£'000
Balance b/fwd	3,000
Proceeds of share issue in the year	**5,000**
Balance c/fwd	8,000

(W5) Dividends paid

	£'000
Retained earnings b/fwd	95,000
Profit from operations	31,000
Cash paid	**(14,000)**
Retained earnings c/fwd	112,000

(b) Overall Hiru is well managed from a cashflow perspective. In particular, repayment of the loan and purchase of long property, plant and equipment based on the positive cashflow from operating activities. The information the statement of cash flows provides to complement the profit and loss account and the balance sheet are:
(1) Report cash generation and cash absorption for a period by highlighting
(i) the significant components of cash flow
(ii) and facilitates comparison of the cash flow performance of different businesses
(2) Provide information that assists in the assessment of their liquidity, solvency and financial adaptability, in particular:
(i) Sheds light on the quality of reported earnings by reconciling earnings with net cash position
(ii) Reveals link between profits and cash, hence demonstrates ability to convert profits into cash
(iii) Analyses the sources of cash inflow and outflow from operating activities, investing activities and financing activities.

Examiner's comments:

Students were able to answer question (a) reasonably well. The better students were able to calculate the dividends paid as well as the cash paid for plant and equipment in (a). The answers to question (b) were well answered.

3. **HOT CHIPS**
(a)

(i) NPV @ 10%

	Year 1	**Year 2**	**Year 3**	**Year 4**
	£'000	£'000	£'000	£'000
Sales Revenue	3,600	1,680	1,320	1,320
Direct materials	(810)	(378)	(324)	(324)
Variable production	(900)	(420)	(360)	(360)
Advertising	(650)	(100)		
Fixed costs	(600)	(600)	(600)	(600)
Net cashflows	640	182	36	36
Discount at 10%	0.9091	0.8264	0.7513	0.6830
PV of cashflows	581.8	150.4	27.0	24.6
	£'000			
PV of future CF	783.9			
Initial investment	800.0			
NPV	-16.1			

(ii) IRR

NPV @ 5%

	Year 1	**Year 2**	**Year 3**	**Year 4**
	£'000	£'000	£'000	£'000
Sales Revenue	3,600	1,680	1,320	1,320
Direct materials	(810)	(378)	(324)	(324)
Variable production	(900)	(420)	(360)	(360)
Advertising	(650)	(100)		
Fixed costs	(600)	(600)	(600)	(600)
Net cashflows	640	182	36	36
Discount at 5%	0.9524	0.9070	0.8638	0.8227
PV of cashflows	609.5	165.1	31.1	29.6
	£'000			
PV of future CF	835.3			
Initial investment	800.0			
NPV	35.3			

IRR = 5%+35.3*[(10%-5%)/(35.3+16.1)]=8.4%

(iii) The payback period = 1 year+((800-640)/800)=1.2 years

(iv) Hot Chips should not invest in 'Sampinge' as the NPV is negative at 10%. The IRR is 8.4% which is lower than the 10% cost of capital which implies that Hot Chips should not be in 'Sampinge'. However, the payback period is just over 1 year (perhaps a project to be sold after 2 years) which implies that they should invest but this is not a reliable method as it does not factor in time value of money.

(b) There are many reasons that could be discussed in support of the view that NPV is superior to other investment appraisal methods:

(1) NPV considers the whole of the investment project
In this respect NPV is superior to payback, which measures the time it takes for an investment project to repay the initial capital invested. Payback therefore, considers cash flows within the payback period and ignores cash flows outside the payback period. Project yielding high returns beyond the payback period are ignored.

(2) NPV considers the time value of money
NPV and IRR are both discounted cashflow models which considers the time value of money whereas Payback is typically not. Time value of money is important for investment appraisal as otherwise the different times cannot be distinguished from each other in terms of value from the perspective of the present value.

(3) NPV is an absolute measure of return
NPV is seen as being superior to investment appraisal methods that offer a relative measure of return, such as IRR, and which therefore fail to reflect the amount of initial investment or the absolute increase in corporate value. Such an increase can be translated to increase in shareholder value.

(4) NPV enables correct comparing across projects
With respect to mutually exclusive projects, NPV always indicates which project should be selected in order to achieve the maximum increase on corporate value. This is not true of IRR

(5) NPV can accommodate changes in discount rates
NPV enables changes in discount rates to be incorporated while IRR ignores such changes as IRR is independent of the cost of capital in all time periods.

(6) NPV has a sensible re-investment assumption
NPV assumes that intermediate cash flows are re-invested at the company's cost of capital, which is reasonable assumption as the company's cost of capital represents the average opportunity cost of the company's providers of finance, i.e., it represents a rate of returns which exists in the real world. By contrast, IRR assumes that intermediate rate available in practice.

(7) NPV can accommodate non-conventional cash flows
Non-conventional cash flows could exist when negative cash flows arise during the life of the projects. With such non-traditional cashflows, therefore IRR can suffer from the technical problem of giving multiple internal rates of return or no internal rate of returns.

Examiner's comments:

Part (a) required students to assess the investment opportunity using the Net Present Value (NPV), Internal Rate of Return (IRR) and Payback Period respectively. Part (a) was done well on average. Good answers showed the workings to get the answers rather than merely showing final answers. Moreover, the better students were able to calculate the fixed costs based on the first year and not vary the amount based on volume in subsequent years. Section (b) was done satisfactorily with better answers discussing the implications of the calculations done in sections (a). Section (c) was done very well.

4. **DAFFODIL**

(a) Costs and quoted prices for the BC and the EX using labour hours to absorb overheads:

			BC (£)	EX (£)
Materials			3,500	8,000
Labour	300 hrs x £15/hr		4,500	
		500 hrs x £15/hr		7,500
Overheads	300 hrs x £10/hr (W1)		3,000	
		500 hrs x £10/hr		5,000
Total cost			11,000	20,500
Quoted price	@ 50% mark-up		16,500	30,750

(W1) Overhead absorption rate is calculated as £400,000/40,000 hrs = £10/hr

(b) Costs and quoted prices for the BC and EX using ABC to absorb overheads

			BC (£)	EX (£)
Materials			3,500	8,000
Labour	300 hrs x £15/hr		4,500	
		500 hrs x £15/hr		7,500
Overheads				
Supervisors	(W2/W3)		180	1,080
Planners	(W2/W3)		280	1,400
Property	(W2/W3)		1,800	3,000
Total cost			10,260	20,980
Quoted price	@ 50% mark-up		15,390	31,470

(W2)

	Costs (£)	*Number of drivers*	*Cost per driver (£)*
Supervisors	90,000	500	180
Planners	70,000	250	280
Property	240,000	40,000	6

(W3)

	Supervisor	*Planner*	*Property*
Cost per driver (W2)	£180	£280	£6
BC	180x1=180	280x1=280	6x300=1,800
EX	180x6=1,080	280x5=1,400	6x500=3,000

Using ABC reduces the cost of BC by 6.7% ((£10,260-£11,000)/£11,000) to £10,260 but increases the costs of EX by 2.3% ((£20,980-££20,500))/£20,500 to £20,980 compared to the absorption costing approach. If the mark-up of 50% is kept, then the price of BC and EX will be £15,390 and £31,470 respectively. The ABC approach enables the cost of BC to be reduced in order to make the proposition more competitive. There could be other reasons for the competitive effect of BC e.g., sales team's approach to the propositions.

(b) Marginal costs are those costs that are incurred as a consequence of the job being undertaken. In this case they would include only materials and the labour. If overheads are included then this is known as total absorption costing.

Overheads are for many businesses fixed by nature and hence do not vary as the number of jobs changes. The absorption costing approach is somewhat arbitrary. The marginal costing approach avoids the problem of uncertainty of budget volume.

The marginal costing (MC) is more understandable by managers. The MC method makes sense at the margin if there is still capacity which will go underutilised and there is a customer who will only be able to pay the lower price compared to the full cost pricing. There is a risk that continually using MC might not cover the full costs and hence make the business not viable.

A more modern approach is to attribute costs to activities and relate to costs drivers – the Activity Based Costing (ABC). This to some extent eradicates the arbitrary cost allocations. However, there will remain issues with respective the politics of how to go about determining the drivers of the costs effectively and methods to track changes as the technology and workforce skill changes. Hence, there will be a tradeoff between the simplicity of MC compared to the complexity of ABC.

In the long run businesses have to cover all costs including fixed overheads in order to make a profit, whichever pricing strategy is adopted.

Examiner's comments:
Part (a) required students to calculate unit costs of the products using different cost allocation methods namely absorption and activity based costings respectively – these were generally well done with better students showing the ability to explain the reasons for the difference in the costs. Part (b) was done well with better students able to explain when it might better to do marginal as opposed to full costing.

Section C

5. (a) The distribution of profits, reflected in the economic identity represented in the following equation, Profit = (Price-Average Cost) x Quantity, rationalises the analysis behind Porter's five forces. Each of the variables in the equation bears on or is affected by one or more of the five forces discussed in the Porter framework. Thus, the relationships between the forces influencing an industry are captured in the simple equation for economic profits.

(1) **Rivalry:** The existence of rivalry would be reflected in price as well as in quantity. The prediction is that increased rivalry would drive prices down and could also cause a redistribution of market shares. Rivalry can also increase competition for scarce input resources and drive up costs.

(2) **Substitute Goods:** The existence of close substitutes would limit the price producers in the industry could charge. Substitute products can also reduce quantity when those substitutes are perceived to be better at satisfying customers' needs or when they are priced lower and demand for the product is elastic.

(3) **Buyer Power:** Buyers can force price down if they hold more bargaining power than producers, thereby converting producer profits to consumer surplus.

(4) **Barriers to Entry:** High barriers to entry will prevent competitors from entering to drive prices down, allowing the current producers to maintain higher prices as well as larger quantities.

(5) **Supplier Power:** If manufacturers of an input hold bargaining power, then they can increase the prices they charge for inputs—the suppliers can capture a portion of the profits in the value chain.

The existence of profits suggests that competitors will certainly attempt to enter the industry. The Porter's five-forces analysis identifies the factors that affect the distribution of value creation within the industry (whether it is to buyers [consumer surplus], suppliers [producer surplus in another industry], or competitors [competition for producer surplus]), and qualifies the extent to which the capturing the profits appears feasible. The equation can act as a simple model for Porter's framework.

(b) Studies on strategic management have focused primarily on inter-firm competition to create competitive advantage. Competition and cooperation have been considered separate modes of firm interaction. However, more recently scholars have been placing emphasis on studies that examine firms simultaneously engaging in cooperation and competition which is called *coopetition*. Coopetition entails when and how the value network is formed between competing firms in order to develop and deliver the value proposition (shorter product lifecycle, convergence of multiple technologies, increasing costs of conducting R&D). Multiple resource requirements often do not reside within a single firm (a) firms in the same industry often cooperate in order to share such resources, (b) then go on to compete to divide the created value jointly. Coopetition is the concept that the forces that shape industry profits are to a great extent the result of choices made by the individual firms within the industry.

As these firms become savvier regarding the reaction of rivals to their own actions, they will choose actions that reduce the likelihood of losing industry profits to price wars, consumer surplus, and/or ineffective negotiations with suppliers. As each firm comprehends its own role within the industry, firms can collectively fashion strategies that "cause" a force to have only a limited effect. If firms ignore the concept of coopetition, they must resign themselves to simply reacting to the industry forces.

Examiner's comments:
Most students who attempted this question did well and had a good grasp of the concepts. The better students for question (a) were able to discuss the implications of the five forces on the profit equation by providing examples where relevant. For question (b), the better students were able to explain the reason for coopetition strategy as well as provide case vignettes to support their answers.

6. (a) Economies of scale arises from reduction in costs due to the spreading of fixed costs over a larger output. Fixed costs are those costs that do not vary directly with output. Fixed costs must be expended in order to initiate production, but also for activities such as selling the output or developing improvements to the output. As the firm's scale of operation increases in terms of volume of output and number of products produced, functions related to marketing, R&D, and purchasing are spread over more units—hence reducing the cost of each of these activities per unit sold. For example, once a firm invests in developing a new product, those R&D costs are fixed regardless of the scale of that product. Hence economies of scale could improve the competitive advantage of firms and it would be challenging for smaller firms or new entrants to compete. Economies of scale – a grand scale – are useful as a deterrent to market entrance by effectively monopolizing the vertical production chain and prohibiting others from participating in the market.

There could be diseconomies of scale. The sources of such diseconomies includes increasing labour costs, spreading specialised resources too thinly, incentive and coordination effects and "Conflicting out" (competitor already a client; information sensitivity, reputation damage).

Moreover, economies of scale could also be disadvantageous for large firms in shrinking markets. Firms that have economies of scale over smaller or newer market entrants typically have large sunk costs. These costs can become a disadvantage when other smaller firms attack the market with a different substitute product priced below the larger firm. This "judo" tactic results in the revenue destruction effect where the larger firm in cutting its price to match the substitute product's price losses more revenue than the smaller firm due to its large sunk costs. Economies of scale in this case are useless, and actually act as a negative force on the larger firm.

Digitalisation could affect economies of scale. Inventory costs drive up the average costs of the goods that are actually sold. The need to carry inventories creates economies of scale because firms doing a high volume of business can usually maintain a lower ratio of inventory to sales. The digitalisation of books (and movies and music) reduces the economies of scale that large firms have because low sales firms can essentially "stock" the same quantity of inventory – the digital files that can be duplicated repeatedly. Moreover, production and

distribution which are separate activities (e.g., for books) could be coupled into a single business model when transformed into a digital format. Larger firms that previously enjoyed a competitive advantage due to their high sales volume and low ratio of inventory to sales now face increased competition from smaller firms that enjoy the same average costs to sales due to inventory. Examples to discuss include Amazon vs Borders (other related ones are movies in the case of Netflix vs Blockbuster and music in the case of Apple iTunes vs HMV Records).

Examiner's comments:
This question was generally well answered. However, in part (a) better students were able to explain not only when economies of scale would be advantageous but also when they might be a disadvantage and supporting their arguments with case examples. In part (b), better student were able to relate the notion of digitisation on economies of scale and provide example from various cases from the book industry to illustrate their answers.

Section D

7. (a) A complete contract eliminates opportunities for shirking by stipulating each party's responsibilities and rights for each and every contingency that could conceivably arise during the transaction. By using a complete contract, a firm can get its trading partner to mimic any and all of the steps that would have been taken by a vertically integrated firm, as well as replicate the profits accruing to each participant in the vertical chain. Therefore, if it were possible to write a complete contract then firms can transact or buy in the market place in order to obtain the product or service they need from other firms or agents. However, it is rarely possible to write a complete contract as there are many contingencies that cannot be fully anticipated. This creates hold up problems and hence it might be better for firms to buy other firms that provide such products or services if there is more likely for such contingencies to arise.

(b) Kingbrew should not automatically buy out Caledonian simply because Caledonian is able to pay a lower price for Kingbrew's products. Rather, Kingbrew should determine whether there is a vertical market failure that would justify a decision to vertically integrate.

<u>Reasons Kingbrew should not vertically integrate:</u>

- The profits earned by Caledonian Bottlers (which incorporate the discounted price for Kingbrew Products) will be incorporated in the price that Kingbrew pays for Caledonian's bottling operation. Therefore, Kingbrew cannot avoid giving Caledonian some or all of the benefit of Caledonian's current monopsony position.
- Supplier and distributor goals are aligned—sell output for maximum profits.
- Performance is easy to observe and output is measurable.
- Transactions are frequent and simple and are easy to contract.
- By allowing the distributor to keep profits, the manufacturer is ensuring that the distributor

will continue to make relationship specific investments and to run an efficient distribution operation.

- The distributor controls the amount of effort to put into distribution, so it may be good to allow the distributor to share some profit in order to provide incentives.

Reasons Kingbrew should vertically integrate:

- Relationship specific investment is required from the distributor, so the relationship may be subject to a hold up problem.
- If product prices are driven so low that hold up is causing vertical market failure or that excessive costs are incurred (from distrust, frequent contract renegotiations, less relationship specific investing, or investing to ensure ex-post bargaining power), then the manufacturer may consider integrating into the distributor. The manufacturer should own the distributor because it ultimately commands most of the surplus in the national arena.

Examiner's comments:
This question was generally well answered. However, in part (a) better students were able to explain the implication of incomplete contracts and when firms might make or buy with case examples. In part (b), better student were able to relate the notion of incomplete contracts and property rights theory as to when to make vs buy in the vertical integration decision.

8. (a) Business model is the customer value proposition, method of value creation, the approach to value capture and the partners needed in the value network. A business model innovation involves systemic changes to the value proposition (such as the marketing mix e.g., product, price, promotion and place (distribution)), value creation (manufacturing, operations and distribution), the approach to value capture (revenue and cost architectures) and the value network (i.e, partners). A firm's business model is different from its business strategy although the two constructs have some overlapping characteristics. In particular, a business model relates to the overall system that drives revenues and costs to deliver the customer value proposition while business strategy refers to the generic choices that firms make to compete effectively in the marketplace (e.g., creating competitive advantage via differentiation, cost leadership and focus, Porter 1985). The business model represents how the activities of the firm work together to execute its strategy; hence, choosing a particular business model means choosing a particular way to compete. Strategy formulation and implementation are an integral part of business model design and evolution. Strategy is determined by answering three questions: What is the offer, who constitutes the target market and how is the offer delivered to the customer? Business model selection constitutes the realised strategy that principally resides within the 'how' question.

Business model innovation is important in strategy formulation as it typically creates superior competitive advantage compared to other forms of innovation (e.g., product and process innovations) because:

i. For competitors it is difficult to identify (as one cannot understand easily what components have been changed and how they have been put together) – systemic nature of change
ii. It is difficult for competitors to replicate even if they were able to identify the components of change.

(b) Challenges that GoodCare might face include

i. Cognitive biases (due to dominant designs) by senior management (e.g., Xerox, Polaroid)
ii. Inability to reconfigure competencies (Kodak)
iii. Inability for the top management team to prioritise business model innovation as other strategic priorities might take precedence
iv. Inability to coordinate change - political factions within the firm
v. Delivery of new proposition using existing business model and processes (e.g., Hertz and Zipcar)

The above answers need to be discussed within the context of GoodCare and OnlineCare by drawing on examples of firms from either the academic literature or other sources (e.g., business press etc).

Examiner's comments:
Overall the questions was well answered. Part (a) required an explanation of business model innovation and its relationship to strategy formulation. The better students were able to discuss the distinction between business model innovation and strategy formulation with examples from various industries. Part (b) required the application of the concepts in part (a) to a case context. Better students were able explain the challenges of business model innovation by drawing on the theory and case vignettes and apply them to the case in question.

CV