UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualifications:-

B.Eng. *M.Eng.*

Biochemical Eng E145: Project Appraisal for Bioprocessing

COURSE CODE	:	**BENGE145**
UNIT VALUE	:	**0.50**
DATE	:	**12-MAY-05**
TIME	:	**10.00**
TIME ALLOWED	:	**3 Hours**

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*Answer **ALL FOUR** questions, but note that Q.4 offers a choice. Where relevant, you are recommended to work in £millions, giving answers to no more than two places of decimals.*

Each question carries marks as follows: Q.1 = 15, Q.2 = 25, Q.3 = 35 and Q.4 = 25, subdivided as shown [ ].

1.

(a) A company's end-of-year accounts include a balance sheet. Describe in as much detail as you can what this is and why it is so named. [3]

(b) A company sells 10,000 tonnes of a product in a certain year, at £9,500 per tonne. In that same year, its sales costs are £4.8 millions and its production cost is £52.4 millions. The loan interest due in that year is £10.7 millions, and the rate of corporation tax (levied on profits after deduction of interest) is 28%. Again in that same year, the fixed assets are valued at £185 millions, the total capital employed is £191 millions, and the owners' funds (the equity) are £48.5 millions.

For that year, what are the Return on Capital Employed (based on PBT) [3]
the Return on Fixed Assets (based on PBIT) [3]
the Return on Sales (based on PBIT), and [3]
the Return on Equity (based on PAT) [3]
all expressed as percentages.

2.

(a) How is the annual net cash flow in a company's operations calculated? [2]

(b) Your company is proposing to build a new plant on a fully developed site, immediately adjacent to another of your company's operations, and reasonably close to a developed urban area, which has good road, rail and sea transport facilities. Electricity and gas are both available adjacent to the plant boundary, and steam, process air and water are also available from the adjoining plant. Using the data given in the accompanying Question 2 Data Sheet:

i. calculate the production cost per tonne of product [12]
ii. calculate the marginal cost of an extra tonne of product [2]
iii. calculate the annual net cash flow [6]
iv. calculate the payback time to the nearest month [3]

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3. Your company is considering investing in a new project, and you are looking at two potential projects, with very different financial structures, as described in the accompanying Question 3 Data Sheet. Your appraisal is being done in a corporate climate where the Hurdle Rate of Return is 18.5%, and where the company has £100 millions of its own funds available for investment.

Which of the two projects would you recommend to the Board of Directors, and why? Your recommendation should cover as many aspects of the investment as you consider relevant. [35]

4. EITHER

(a) Your company is proposing to build a new pharmaceutical plant with the following main characteristics:

- the production process, which is a liquid phase process, occurs under moderate temperatures and pressures, with minimal noise emission;
- there is a solid residue from the manufacturing process, but it is organic and fibrous, and has no inorganic content;
- no potentially explosive mixtures are formed in the process, nor are any aerosols formed;
- a toxic gas is evolved during production, which is readily absorbed and destroyed by contact with ethanol;
- the product is an organic liquid, which is flammable (but not readily so) and is otherwise not hazardous;
- nitrogen compounds are involved in the process, but no phosphates.

The local planning authority is minded to approve your application to build the plant, but it is in a very sensitive area, so there will be an effectively zero pollutant discharge restriction in the permission (i.e. no detectable pollutant emissions). What process design steps will you include to ensure compliance with this restriction?

OR

(b) In the appraisal of the construction and operation of any biochemical plant, risk may be encountered at various stages and in various ways. Identify these various impacts, and describe how each impact of risk can be minimised. [25]

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DATA SHEET – Question 2

Investment	
Fixed Capital Investment - plant and vehicles	£115 millions
buildings	£ 20 millions
Start-Up Costs	£ 10 millions
Working Capital	one third of annual Production Cost
Loan	two thirds of FCI, interest rate 8% per annum
Loan interest accrued during construction	8% of FCI
Output of plant	20,000 tonnes per annum
Sales price	£9,000/tonne
Sales and distribution cost	4% of sales revenue
Raw material cost	£2500/tonne product
Utilities cost	£ 550/tonne product
Other variable costs	£ 350/tonne product
Labour	
Shift labour	5 shifts of 6 people at £485 each per week
Lab. & maint. labour	25% of shift labour cost
Other plant labour	7 people at £420 per week each
Supervision	22% of total labour
Payroll costs	27% of total labour and supervision
Waste disposal cost	1.5% of Production Cost
Maintenance & cleaning materials	4% of Production Cost
Insurances	2.5% of FCI
Communications	0.5% of Production Cost
Local taxes (rates)	2% of FCI
Depreciation	
Plant and vehicles	12% straight line
Buildings	5% straight line
Other investment	0%
Overheads	1.5% of FCI
Corporation (profits) tax	30% of net profit (after deduction of interest)

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DATA SHEET – Question 3

Project		1	2
Construction period		2 years	3 years
Economic lifetime		10 years	10 years
Total Capital Employed		£95 millions	£165 millions
Invested as:	Year -3	-	£ 45 millions
	Year -2	£35 millions	£ 45 millions
	Year -1	£35 millions	£ 45 millions
	Year 0	£25 millions	£ 30 millions
Net Cash Flows			
Operating year	1	£37.80 millions	£73.20 millions
	2	£46.20	£81.50
	3	£46.20	£81.50
	4	£46.20	£81.50
	5	£46.20	£81.50
	6	£46.20	£81.50
	7	£46.20	£81.50
	8	£46.20	£81.50
	9	£46.20	£81.50
	10	£58.60	£99.80

[Note: You may use graph paper if you wish.]

END OF PAPER