

Note:

- 1) Marks as indicated [n]
- 2) Type C exam - Aid sheet only allowed - Tables to be handed out
- 3) Explain clearly the rationale for the steps in your procedures. Full marks will **NOT** be given for numbers only.

- 1) Explain your understanding of and the significance of the following for the economic design of engineering systems.
 - (a) [3] Elasticity of demand
 - (b) [3] Investment tax credit
 - (c) [4] The marginal rate of substitution between two inputs, their relative prices and the relationship between these quantities

- 2) A firm is planning to produce and sell a new product over an 11 year period. It already owns a building but must buy \$5 million of machinery (20% cca). The land was bought 5 years ago for \$200,000 and the building has a book value now of \$150,000 (5% cca). The market value of the land is \$300,000 and the building \$100,000 but in 11 years they could be sold for \$500,000 and \$100,000 respectively. The firm estimates it can sell \$2 million of product each year with operating costs of \$1 million. The machinery will be worth \$1.2 million in 11 years. The firm's MARR is 10% and the tax rate is 40% .
 - a) [10] Compute the depreciation amounts by year for buildings and machinery
 - b) [20] Find the present value of the project.
 - c) [5] The major uncertainties are in the future prices of land and buildings. Estimate the range of future prices for each that cause the present worth to be negative.

- 3) Suppose your project is expected to change your firm's financial position in the first year as follows (in \$000)

Sales	500
Manufacturing cost of sales	
Direct Labour	35
Direct Material	25
Overhead	10
Depreciation	30
	100
Selling and admin expenses	25
(direct project association)	
equipment purchase	100
Decrease in cash revenue of other products	10
Increase in accounts receivable	30
Increase in inventory	20
Increase in current liabilities	30
Income taxes associated with the project	100
repayment of old loan	50

- a) [10] Determine the change in the firm's working capital
- b) [15] Determine the net cash flow for the first project year.
- 4) A ship building company has a non-cancelable contract to build a small cargo vessel. Construction involves a cash outlay of \$250,000 at the end of each of the next two years. At the end of the third year the firm receives \$600,000. An alternative production process speed production. It results in an outlay \$520,000 at the end of year one and receipt of \$600,000 at the end of year two.
- a) [15] Find the range of MARR values that make the second process more profitable.
- b) For an MARR of 10%, suppose the second process requires the union to agree to changes in the work rules. The negotiations cost the firm amount C and (if successful) result in added costs of amount CU . p = probability of the union agreeing (success).

Given values of C and CU , find expressions from which the following can be calculated (Use a decision tree to explain your logic. Each part is independent)

- (i) [5] the values of p for which the firm is indifferent between negotiating and not negotiating.
- (ii) [5] Suppose a consultant were available that knew whether or not the negotiations would be successful. Find the their value as a function of p .
- (iii) [5] Find the maximum extra benefits that the firm could give the union members (i.e. the value of CU). Show how CU varies with the value of p .