SCHOOL OF ENGINEERING

EXAMINATIONS: NOVEMBER 2017

COURSE AND CODE: PROJECTS AND THE ENVIRONMENT ENCH4PE

DURATION: 2 HOURS

TOTAL MARKS: 100

INTERNAL EXAMINER(S): DR HW BERNHARDT

INTERNAL MODERATOR(S): DR D LOKHAT

EXTERNAL MODERATOR: PROF P MUSONGE

INSTRUCTIONS:

1. ALL questions should be attempted.

2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.

3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.

4. Appropriate formulae are provided on page 3.
QUESTION 1

1.1 In order to assess the viability of new projects it is necessary to have information on what the capital expenditure for this project is likely to be. Briefly describe the different methods that are being used to estimate the capital costs of new ventures, and state the expected accuracy of these estimating methods. (4 marks per method).

(24)

1.2 Discounted Cash Flow (DCF) Analysis is a tool that is useful in evaluating the financial viability of projects. Briefly explain how this technique is applied.

(6)

TOTAL  /30/ 

QUESTION 2

2.1 (a) A company’s cost accountant has worked out that cost of producing and selling the company’s main revenue-earning product is as follows: Production cost R112.54, Warehousing cost R5.23, Marketing cost R17.28. The product is sold for R186.55. If the monthly overhead costs of the company are R58 309, what is the monthly breakeven volume for this product?

(6)

(b) If the company’s average sales of this product are 2600 units per month, by what percentage could they increase their monthly gross profit if they outsourced the warehousing and marketing function for a cost of R13.80 per unit.

(8)

2.2 The company mentioned in question 2.1 above is planning to invest in a major expansion estimated to cost R 6 780 000. This expansion is to be implemented in 4 years and 7 months’ time. How much money must be set aside every month to accumulate the capital required for this expansion, assuming the money accumulated earns interest at the rate of 10.4% p.a, compounded monthly?

(6)

TOTAL  /20/
3.1 The diagram above represents the main activities of a project (represented by arrows) and the length of time (in days) estimated for these activities (shown by the figures on the arrows). Use the information to determine the critical path for the project, and the length of time the project is expected to take. Show your working details clearly.

(6)

3.2 "Crashing" is the term used for a method to speed up the completion of a project by allocating extra resources to shorten certain activities. The following table lists the regular and crash times of the activities on the project depicted above, and the related crash cost. If the standard cost of executing the project is R 1000 per day, determine the optimum cost and corresponding project length that can be achieved by crashing activities. Use a table to show how you work out the optimum cost/length for the project.

(14)

<table>
<thead>
<tr>
<th>Activities</th>
<th>Regular time</th>
<th>Crash time</th>
<th>Crash Cost (Rand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>3</td>
<td>2</td>
<td>800</td>
</tr>
<tr>
<td>2-3</td>
<td>7</td>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>3-10</td>
<td>11</td>
<td>9</td>
<td>650</td>
</tr>
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<td>2-4</td>
<td>5</td>
<td>3</td>
<td>500</td>
</tr>
<tr>
<td>4-7</td>
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<td>5</td>
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</tr>
<tr>
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<td>4</td>
<td>550</td>
</tr>
<tr>
<td>7-8</td>
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</table>

TOTAL /20/
QUESTION 4

Molasses is a common feedstock as source of fermentable sugars (C_{6}H_{12}O_{6}) for the production of ethanol (C_{2}H_{5}OH). An ethanol distillery has a production capacity of 20 000 litres per day of potable ethanol (98.4 % V/V, relative density 0.789).

(a) Calculate the mass of molasses (in tons) that will be required for this process per day. 

(b) Calculate the volume of carbon dioxide (in m^{3}) that will be released into the atmosphere per day.

[Relevant data for the process: Efficiency of conversion of fermentable sugars to ethanol = 88%. Efficiency of recovery of ethanol from beer = 95%. Atmospheric pressure = 1 atm, temperature of ambient air = 25^\circ C. Molasses contains 36% sucrose (C_{12}H_{22}O_{11}) and 15% fermentable sugars (as C_{6}H_{12}O_{6}) by mass. 1 kmol CO_{2} at STP has a volume of 22.4 m^{3}. Atomic masses C = 12; H = 1; O = 16].

TOTAL /30/

Formulae

\[ PV = \frac{FV}{(1+i)^n} \]

\[ FV = \frac{A \left[(1+i)^n - 1\right]}{i} \]

\[ NPV = \sum_{t=0}^{n} \frac{C_t}{(1+k)^t} \]