



**PROGRAM** : BACHELOR OF TECHNOLOGY  
CHEMICAL ENGINEERING

**SUBJECT** : PRODUCTION ENGINEERING:  
CHEMICAL INDUSTRY 4

**CODE** : PCI411

**DATE** : SUMMER SUPPLEMENTARY EXAMINATION  
9 JANUARY 2017

**DURATION** : (X-PAPER) 08:00-11:00

**WEIGHT** : 40 : 60

**TOTAL MARKS** : 92

---

**EXAMINER** : DR R. HUBERTS 080207003

**MODERATOR** : PROF M.S. ONYANGO 2242

**NUMBER OF PAGES** : 3

---

**INSTRUCTIONS** : ANSWER ALL QUESTIONS.  
NON-PROGRAMMABLE CALCULATORS PERMITTED  
(ONLY ONE PER CANDIDATE).

---

### QUESTION 1

$C_j$		170	200	0	0	0	
	VAR	A	B	S1	S2	S3	VAL
0	S1	0	0	1	-4	1	40
200	B	0	1	0	-1	1	70
170	A	1	0	0	2	-1	20
	Zj	170	200	0	140	30	17400
	$C_j - Z_j$	0	0	0	-140	-30	

Consider the linear programming tableau above for the refurbishment of two types of equipment: A and B. In the table, the first constraint is labour hours available, the second wiring time, and the third copper wire available in kg.

- 1.1. Is the solution feasible, optimum, or both? (2)
- 1.2. What is the profit represented by the table in Rand? (1)
- 1.3. What percentage of the profit is due to the refurbishment of Equipment A? (6)
- 1.4. If someone wanted to buy copper wire from you, how much can you sell, and at what price? (9)
- 1.5. Does the answer you obtained for 1.4 make sense? (1)

[19]

### QUESTION 2

- 2.1. Name methods you can use to obtain initial solutions and to solve transport problems. (3)
- 2.2. Draw a diagram of a financial tree. (15)

[18]

### QUESTION 3

Say you have R600000 to invest. You may either put it in a bank or invest in a small new chemical plant. There is a 70% chance of the plant producing a profit of R550000 in five years' time. The remaining chance is a loss of R50000. Interest received from the bank is expected to be R300000. Use the methods taught in this course to decide on what the best course of action is.

[20]

### QUESTION 4

Activity	$t_a$	$t_m$	$t_b$	Predecessor(s)	Normal	Crash Cost
A	1	2	3	-	10	15
B	1	8	9	A	8	12
C	2	3	10	B	9	14
D	5	6	7	A	5	6
E	4	5	6	C,D	7	9

costs (in Thousands) are given in the table. Indirect costs are R2000 per week.

- 4.1. Draw the AON diagram for the task at hand. (17)
- 4.2. What is the cost of the project? (7)

[24]

**QUESTION 5**

Some months ago, you set up a small enterprise that sells pH meters, and can manufacture up to 5 units per month, which you can sell for a profit of R50000. If you receive orders for more than 5 units, you can get the pH meters from another source, but will only be able to sell them for a profit of R25000. Orders and the resulting sales up to now are given in the accompanying table.

MONTH	SALES
JAN	4
FEB	6
MAR	5
APR	5
MAY	4
JUN	6
JUL	5
AUG	5
SEP	4
OCT	6

- 5.1. Use a moving average of 4 to predict the sales for next month. (3)
- 5.2. Simulate the sales in the next 5 months using the following random numbers, and calculate by how much your profit will increase over these months if you increase your monthly production capacity by one pH meter unit. (8)

MONTH	NOV	DEC	JAN	FEB	MAR
RAND.NO.	59	70	28	43	61

**[11]****TOTAL MARKS = 92****FULL MARKS = 92**