NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

COMPUTER APPLICATION IN CIVIL ENGINEERING

TCW 2104

First Semester Examinations paper

December 2016

This examination paper consists of 5 pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: **Mrs S. Nhandara**

INSTRUCTIONS

1. Answer ALL questions
2. ALL Charts and Spread Sheets must be fully labeled

MARK ALLOCATION

QUESTION	MARKS
1	35
2	25
3	40
TOTAL	100

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QUESTION 1

The curing of concrete is an essential process which ensures that a concrete mix attains its full strength. A concrete batch was designed to reach a 28day compressive strength of 40MPa. The strength results of its sample are shown in table 1.

a.   Prepare the time series chart and answer the questions below   (4 marks)

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Compressive Strength (Mpa)	5,8	12,6	18,5	20,0	21,8	24,9	28,8	29,2	30,1	33,5	34,3	35,0	35,2	36,1

Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Compressive Strength (Mpa)	36,6	37,1	37,8	38,3	39,7	41,4	41,7	43,1	43,2	43,6	44,0	45,5	46,4	48,8

Table 1

b.   (i) Describe the trend of the compressive strength with time   (3 marks)

       (ii) Given that the expected strength results for the 3, 7, 14 and 28days compressive tests are 40%, 65%, 90% and 99% of the target strength respectively, how do the results of this sample compare with the expected?   (3 marks)

c.   In addition to sample1 above, four more concrete samples were made from different batches which were also designed to reach the 40MPa Compressive Strength (C.S) at 28days. Their test results are shown in table2

       (i) ADD the time series of the four additional samples to that of sample1   (16 marks)

       (ii) Compare the test results of samples 2,3 and 4 with those of sample 5   (6 marks)

       (iii) In your judgement which sample best represents the most appropriate concrete mix design (the best design), motivate your answer   (3marks)

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Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Number														
2 - C.S (Mpa)	2,1	5,4	7	8,2	9,7	10,4	12,8	13	13,2	13,4	13,6	14,2	14,8	15,3
3 - C.S (Mpa)	5,3	10,2	15,8	17,6	20,4	22,7	25,5	26,3	27,5	28,6	29,1	30,4	31,8	32,3
4 - C.S (Mpa)	4,2	8,9	16,6	19,3	22,1	24,5	26,3	27,8	29	31,2	33,8	35,1	36,2	37,4
5 - C.S (Mpa)	8,9	15,2	20	23,1	25,7	27,9	30,4	31,8	33,2	34,5	35	37,6	38,6	40,5

Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Sample Number														
2 - C.S (Mpa)	15,6	15,9	16,2	16,5	16,8	17,1	17,4	17,7	18,1	18,4	18,8	19,3	19,8	20,7
3 - C.S (Mpa)	32,5	32,7	32,8	33	33,2	33,5	33,6	33,8	34,1	34,3	34,7	35,2	35,4	35,9
4 - C.S (Mpa)	37,7	38,1	38,4	38,5	38,8	39,1	39,2	39,5	39,7	40	40,3	40,6	40,9	41,5
5 - C.S (Mpa)	41,8	43,1	44,5	45,7	46,9	48,2	49,5	50,8	52,1	53,4	54,8	56,2	57,6	58,8

Table 2

[35 marks]

QUESTION 2

a. (i) To address the water crisis in Matebeleland South Province a dam is to be constructed in Gwanda. The stadia tacheometry data is shown in table3. You are required to provide the reduced levels of the Positions indicated in the survey using a Microsoft Excel spreadsheet. The following equations apply:

Horizontal Distance, $D = Ks \cos^2\theta + C \cos\theta$
Vertical Component, $V = \frac{1}{2}(Ks \sin 2\theta) + C \sin\theta$
Reduced Level, $RL_p = RL_x + h_i + V - m$
Staff intercept, $\quad s = u - l$

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K = 100,   C = 25, $RL_x = 2\,874.86m$, $h_i = 1.739m$

Staff Point	Vertical Circle, θ^o	Staff readings(m)		
		Centre,m	Upper,u	lower, *l*
P1	52,3	5,75	6,42	4,93
P2	55,6	5,16	5,95	4,36
P3	55,7	5,93	6,67	5,23
P4	54,2	5,39	6,44	4,88
P5	53,7	5,01	5,86	4,21
P6	52,9	6,11	6,87	5,41
P7	53,8	6,22	7,03	5,64
P8	55,4	6,00	6,77	5,19
P9	54,1	6,36	7,16	5,77
P10	55,0	5,88	6,59	5,03
P11	56,8	5,51	6,38	4,76
P12	54,5	5,26	5,99	4,42

Table 3   (20 marks)

(ii) Explain the consequences of using wrong/false reduced levels in the context of dam design and construction   (5 marks)

[25 marks]

QUESTION 3

a.   Water samples collected from different natural water sources in Charumbira Rural District were tested for the presence of contaminants. The numbers of e-coli found in each sample are shown in table 4. By use of Microsoft Excel formulae, Show:
i) The measures of central tendency   (6 marks)
ii) The measures of spread of the given data   (6 marks)

b.   i) Prepare the frequency table including the class range and class intervals (10 marks)
ii) Plot a suitable chart as well as the box and whisker diagram   (10 marks)
iii) Describe the extent of contamination in the water samples   (4 marks)

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iv) In light of the fact that the samples were taken from potential drinking water sources what recommendations would you give to address water quality issues   (4 marks)

[40 marks]

105	5	10	16	85	119	20	41	63	33
121	36	24	11	3	67	137	68	74	108
52	96	75	91	9	60	87	29	31	106
25	162	144	0	48	72	2	129	9	8
14	16	125	7	46	108	18	13	65	4

Table 4

END OF EXAMINATION

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