**FACULTY OF SCIENCE**

**DEPARTMENT OF FOOD TECHNOLOGY**

**MODULE:**    FTN3BF3
                FOOD TECHNOLOGY III
                (NATIONAL DIPLOMA FOOD TECHNOLOGY*)*

**NOVEMBER EXAMINATION**

**DATE: 12 NOVEMBER 2014**                **SESSION:  8:30 – 11:30**

**EXAMINER**                                                        **Dr S de Kock**

**EXTERNAL MODERATOR**                                    **Dr N Emmambux**

**DURATION   3 HOURS**                        **MARKS    182 (180=100%)**

**NUMBER OF PAGES:  9 PAGES, INCLUDING 4 ANNEXURES**

**INSTRUCTIONS:  ANSWER ALL QUESTIONS**
                **CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)**

**REQUIREMENTS:  2 ANSWER SCRIPTS PER STUDENT**

**INSTRUCTIONS TO STUDENTS**:

1.      ANSWER ALL QUESTIONS.
2.      NUMBER YOUR ANSWERS CORRECTLY AND CLEARLY.
3.      QUESTIONS MAY BE ANSWERED IN ANY ORDER, BUT SUB-SECTIONS OF
        QUESTIONS MUST BE ANSWERED TOGETHER.
4.      MARKS WILL BE DEDUCTED FOR ILLEGIBLE WRITING.
5.      GOOD LUCK!

QUESTION 1

You have started your own food consulting business. Explain the following phenomena and advise clients on what they can do to overcome the problems experienced by them in their different processing operations:

1.1     A cheese manufacturer found that his Gouda cheese is too soft.          (5)
1.2     An ice cream manufacturer has large ice crystals in his product (hint:
        think through all processing steps from formulation to hardening).      (7)
1.3     A manufacturer of powdered egg whites to be used in the baking industry
        is complaining about browning in his product.                          (6)
1.4     A local baker at the Spar complains that his bread (which is made from
        ONLY wheat flour, water, salt and yeast) does not have a good loaf
        volume and that it has a short shelf life.                              (11)
                                                                               **[29]**

QUESTION 2

You are employed as a quality assurance manager at a beer brewing company.

2.1     Describe brewing as part of the beer manufacturing procedure (1/2 mark
        per fact).                                                             (15)

2.2     The bottles you receive for bottling of the beer arrives in batches of
        30000. You have agreed with the supplier that you will accept a load
        provided that there is no more than 1% broken or chipped bottles. Make
        use of the Military Standards 105D method (single normal inspection
        level) together with the attached tables and describe how you will go
        about taking samples, and when you would accept or reject a load.       (6)

2.3     The beer is filled into 340 ml bottles. As the quality assurance manager,
        you have to make sure that the fill volume is in accordance with the
        declared volume on the label. You are prepared to take a risk of 7% of
        the units being below volume. You have taken 5 consecutive samples
        from the line and this was repeated 5 times. The results obtained are
        tabulated as follows:

| Sample | Volume (ml) | | | | |
|---|---|---|---|---|---|
| 1 | 342 | 344 | 340 | 342 | 335 |
| 2 | 345 | 338 | 342 | 342 | 340 |
| 3 | 335 | 342 | 342 | 335 | 342 |
| 4 | 346 | 343 | 336 | 345 | 341 |
| 5 | 342 | 340 | 342 | 335 | 342 |

2.3.1   Use this data and the attached tables to determine if the process is in control and, if necessary, suggest adjustments to be made. (15)

2.3.2   Draw up a quality control chart that could be used at the point of filling in order to ensure correct product filling. (6)

**[42]**

## QUESTION 3

Describe the manufacturing procedure of Swiss cheese (1/2 mark per fact). **[8]**

## QUESTION 4

Match column B with column A (e.g. 1. f)

| A | B |
|---|---|
| 1. SFI | a. Amount of glucose |
| 2. Lysozyme | b. Nitrates |
| 3. Trans fatty acid | c. High melting point |
| 4. DE | d. Exudation |
| 5. Myofibrillar proteins | e. Should be higher in a chocolate coating in summer |
| 6. Post-mortem glycolysis | f. Emulsifiers in sausages |
| 7. Curing | g. Germination |
| 8. Bran | h. Decline in ATP |
| 9. Malting | i. Antimicrobial properties |
| 10. Rigor mortis | j. High mineral content |

**[10]**

## QUESTION 5

5.1   Describe the break system as part of the roller milling system that is used for the milling of wheat. (5)

5.2   Explain how and why wheat is conditioned before milling. (11)

5.3   Describe the basic processing operations of breadmaking. (10)

5.4     Give a detailed flow diagram for the wet milling process of maize (1/2 mark per
        fact).                                                                   (6)

                                                                              **[32]**

## QUESTION 6

State whether the following statements are true or false and motivate your answer EVERY
time:

6.1     Cookies are produced with strong flour
6.2     A high falling number is indicative of a low amylolytic activity in flour
6.3     Baking powder is the same as baking soda
6.4     Substituting some of the sucrose in a bread formulation for HFCS will enhance
        surface browning
6.5     Sorghum beer is bitter
6.6     The only reason for pasteurizing an ice-cream mix, is to render it free from pathogens
6.7     The temperature of the water used to wash eggs, has to be 10°C above the temperature
        of the incoming egg
6.8     The iodine value of an oil is an indication of its saturation
6.9     Skim milk powder is added in the manufacturing of yoghurt
6.10    The extraction rate of South African mills is 50%


                                                                              **[15]**
                                             (True/false: ½ mark; reason: 1 mark)


## QUESTION 7

Explain how poultry differs from cattle (cows) with regards to the following:

7.1     Slaughtering of the animals                                             (4)
7.2     Rigor mortis and post mortem glycolysis of the muscles                  (5)
7.3     Chemical deterioration of the meat                                      (3)
                                                                              **[12]**


## QUESTION 8

8.1     Describe 4 processing steps used in the refining of oils which are designed to take out
        undesirable components in the oil.                                      (8)
8.2     Explain how emulsifiers can be manufactured from oils.                   (5)
                                                                              **[13]**

QUESTION 9

Due to a demand from consumers, there is a worldwide move in the food industry to more healthy and low fat foods. In the following food commodities, state which one of each pair is higher in fat and explain why (hint: think about formulations, manufacturing procedures, product properties etc.)

| | | |
|---|---|---|
| 9.1 | Hardened ice cream and soft serve | (5) |
| 9.2 | Mayonnaise and pourable salad dressings | (3) |
| 9.3 | Viennas and filet steak | (4) |
| 9.4 | Yoghurt and frozen yoghurt | (3) |
| 9.5 | Ricotta and cheddar cheese | (4) |
| 9.6 | Whole egg powder and egg white powder | (2) |

**[21]**

**SAMPLE-SIZE CODE LETTERS FOR SAMPLING BY ATTRIBUTES FROM MIL-STD-105 D**

| Lot or Batch Size | Special Inspection Levels | | | | General Inspection Levels | | |
|---|---|---|---|---|---|---|---|
| | S-1 | S-2 | S-3 | S-4 | I | II | III |
| 2 to 8 | A | A | A | A | A | A | B |
| 9 to 15 | A | A | A | A | A | B | C |
| 16 to 25 | A | A | B | B | B | C | D |
| 26 to 50 | A | B | B | C | C | D | E |
| 51 to 90 | B | B | C | C | C | E | F |
| 91 to 150 | B | B | C | D | D | F | G |
| 151 to 250 | B | C | D | E | E | G | H |
| 251 to 500 | B | C | D | E | F | H | J |
| 501 to 1200 | C | C | E | F | G | J | K |
| 1201 to 3200 | C | D | E | G | H | K | L |
| 3201 to 10 000 | C | D | F | G | J | L | M |
| 10 001 to 35 000 | C | D | F | H | K | M | N |
| 35 001 to 150 000 | D | E | G | J | L | N | P |
| 150 001 to 500 000 | D | E | G | J | M | P | Q |
| 500 001 and over | D | E | H | K | N | Q | R |

Special inspection levels may be used when relatively small sample sizes are necessary and large sampling risks can and must be tolerated. Unless otherwise specified, general inspection level II should be used; general inspection level I may be used when less discrimination is needed and III when greater discrimination is needed. In each case the higher the number the more discriminatory the plan.

**ACCEPTABLE QUALITY LEVELS (Normal Inspection)**

| Sample Size code Letter | Sample size | 0.010 Ac Re | 0.015 Ac Re | 0.025 Ac Re | 0.040 Ac Re | 0.065 Ac Re | 0.10 Ac Re | 0.15 Ac Re | 0.25 Ac Re | 0.40 Ac Re | 0.65 Ac Re | 1.0 Ac Re | 1.5 Ac Re | 2.5 Ac Re | 4.0 Ac Re | 6.5 Ac Re | 10 Ac Re | 15 Ac Re | 25 Ac Re | 40 Ac Re | 65 Ac Re | 100 Ac Re | 150 Ac Re | 250 Ac Re | 400 Ac Re | 650 Ac Re | 1000 Ac Re |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 2 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 |
| B | 3 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 |
| C | 5 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ |
| D | 8 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ |
| E | 13 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ |
| F | 20 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ |
| G | 32 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ |
| H | 50 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| J | 80 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| K | 125 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| L | 200 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| M | 315 | ↓ | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| N | 500 | ↓ | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| P | 800 | ↓ | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| Q | 1250 | ↓ | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| R | 2000 | ↓ | 0 1 | 1 2 | 2 3 | 3 4 | 5 6 | 7 8 | 10 11 | 14 15 | 21 22 | 30 31 | 44 45 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |

↓  =  Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.

↑  =  Use first sampling plan above arrow.

Ac  =  Acceptable number.

Re  =  Rejection number.

## FACTORS FOR THE CALCULATION OF SIGMA CONTROL CHARTS FOR X, R CHARTS

| No of determinations in samples | Charts for averages | Distribution charts | | Factors for standard deviation |
|---|---|---|---|---|
| | Factors for control limits | Factors for control limits | | |
| n | $A_2$ | $D_3$ | $D_4$ | $d_2$ |
| 2 | 1.880 | 0 | 3.268 | 1.128 |
| 3 | 1.023 | 0 | 2.574 | 1.693 |
| 4 | 0.729 | 0 | 2.282 | 2.059 |
| 5 | 0.577 | 0 | 2.114 | 2.326 |
| 6 | 0.483 | 0 | 2.004 | 2.534 |
| 7 | 0.419 | 0.076 | 1.924 | 2.704 |
| 8 | 0.373 | 0.136 | 1.864 | 2.847 |
| 9 | 0.337 | 0.184 | 1,816 | 2.970 |
| 10 | 0.308 | 0.223 | 1.777 | 3.078 |

## THE AREA UNDER THE NORMAL CURVE

k is the multiplier for the standard deviation which will cover that part of the area under the curve, on both sides of the average, as indicated in the tabulated values.

| K | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0280 | .0319 | .0359 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0754 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 |
| 0.3 | .1179 | .1217 | .1255 | .1294 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 |
| 0.4 | .1555 | .1591 | .1628 | .1665 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 |
| 0.5 | .1914 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 |
| 0.6 | .2258 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 |
| 0.7 | .2580 | .2612 | .2642 | .2674 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 |
| 0.8 | .2882 | .2910 | .2939 | .2967 | .2996 | .3023 | .3051 | .3079 | .3106 | .3133 |
| 0.9 | .3159 | .3186 | .3213 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 |
| 1.0 | .3413 | .3438 | .3461 | .3486 | .3508 | .3531 | .3554 | .3577 | .3599 | .3612 |
| 1.1 | .3643 | .3666 | .3686 | .3708 | .3729 | .3749 | .3770 | .3791 | .3810 | .3830 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 |
| 1.3 | .4032 | .4050 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 |
| 1.4 | .4192 | .4207 | .4223 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 |
| 1.5 | .4331 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4430 | .4441 |
| 1.6 | .4452 | .4464 | .4474 | .4485 | .4496 | .4505 | .4515 | .4525 | .4535 | .4545 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4609 | .4616 | .4625 | .4633 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4700 | .4706 |
| 1.9 | .4713 | .4719 | .4726 | .4733 | .4738 | .4744 | .4751 | .4756 | .4762 | .4767 |
| 2.0 | .4773 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 |
| 2.1 | .4821 | .4826 | .4831 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 |
| 2.2 | .4862 | .4865 | .4868 | .4871 | .4873 | .4878 | .4881 | .4884 | .4888 | .4890 |
| 2.3 | .4893 | .4895 | .4898 | .4902 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 |
| 2.4 | .4919 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 |
| 2.5 | .4938 | .4940 | .4941 | .4944 | .4945 | .4946 | .4948 | .4949 | .4915 | .4952 |
| 2.6 | .4953 | .4955 | .4957 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 |
| 2.8 | .4974 | .4975 | .4977 | .4977 | .4977 | .4978 | .4979 | .4980 | .4980 | .4981 |
| 2.9 | .4981 | .4982 | .4983 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 |
| 3.0 | .4987 | | | | | | | | | |
| 3.5 | .4998 | | | | | | | | | |
| 4.0 | .4999 | | | | | | | | | |
| 4.5 | .4999 | | | | | | | | | |
| 5.0 | .4999 | | | | | | | | | |

The tabulated values multiplied by 100 will give percentage.