

# Statistics - Higher National Diploma (HND)

## Semester 4

|   |    |
|---|----|
| Course: OPERATIONS RESEARCH III .....                       | 2  |
| Course: DEMOGRAPHY II .....                                 | 6  |
| Course: NON-PARAMETRIC STATISTICS .....                     | 12 |
| Course: STATISTICAL COMPUTING .....                         | 16 |
| Course: TIME SERIES ANALYSIS .....                          | 21 |
| Course: MULTIVARIATE METHODS AND STOCHASTIC PROCESSES ..... | 25 |
| Course: PROJECT .....                                       | 29 |

## Course: OPERATIONS RESEARCH III

|   |                               |  |  |
|---|-------------------------------|--|--|
| <b>Programme: Statistics (Higher National Diploma)</b>  |                               |  |  |
| <b>Course: Operations Research III</b>  | <b>Course Code: STA 421</b>   | <b>Total Hours:</b>                      | <b>5</b>                                     |
| <b>Year: 2</b><br><b>Semester: 4</b>  | <b>Pre-requisite: STA 411</b> | <b>Theoretical:</b><br><b>Practical:</b> | <b>2 hours /week</b><br><b>3 hours /week</b> |
| <b>Goal:</b> This course is designed to further develop students' knowledge of techniques and application of operations research.   |                               |  |  |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:<br><br><ol style="list-style-type: none"><li>1. Understand the revised simplex method.</li><li>2. Understand the definition, scope and solution of integer programming problems.</li><li>3. Understand further inventory theory (non-deterministic models).</li></ol> |                               |  |  |

| Theoretical Content  |  |  |                            | Practical Content   |   |                            |
|--|--|--|----------------------------|---|---|----------------------------|
| Week   | Specific Learning Outcomes   | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| <b>General Objective 1 (STA 421): Understand the revised simplex method.</b>   |  |  |                            |   |   |                            |
| 1  | 1.1 Explain the revised simplex method   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 2  | 1.2 Apply the revised simplex method to simple problems  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 3  | 1.3 State the advantages of the revised simplex method over the standard simplex method from problems solved in 1.2                  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 2 (STA 421): Understand the definition, scope and solution of integer programming problems.</b> |  |  |                            |   |   |                            |
| 4  | 2.1 Define the nature of an integer programming problem.<br>2.2 Outline the popular methods of solving integer programming problems. | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 5  | 2.3 Solve problems by the branch and bound algorithm.  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 6  | 2.4 Solve problems by the Gomory cutting planes method   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 7  | 2.5 Discuss mixed-integer programming<br>2.6 Discuss uses of integer programming to the introduction of logical variables.           | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

| Theoretical Content   |  |  |  | Practical Content   |   |  |
|---|--|--|--|---|---|--|
| Week  | Specific Learning Outcomes   | Teacher's activities                     | Resources                              | Specific Learning Outcomes  | Teacher's activities  | Resources                              |
| 8   | 2.7 Solve assignment problems using integer programming  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |
| <b>General Objective 3 (STA 421): Understand further inventory theory (non-deterministic models).</b> |  |  |  |   |   |  |
| 9   | 3.1 Explain simple inventory decisions using the newsboy problem (single period)<br>3.2 Carry out marginal analysis of the newsboy problem | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |
| 10  | 3.3 Determine the optimal solution of the newsboy problem using marginal analysis<br>3.4 Explain simple multi-period inventory policies    | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes<br>Software | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes<br>Software |
| 11  | 3.5 Compare continuous review and periodic review procedures for analysing multi-period inventory systems                                  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |
| 12  | 3.6 Explain the EOQ model for uncertain demand under simple continuous review  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |
| 13  | 3.7 Solve simple inventory problems using the model met in 3.6   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |
| 14  | 3.8 Explain the EOQ model for normally distributed demand  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes             | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes             |

| Theoretical Content |  |  |                            | Practical Content   |   |                            |
|---------------------|--|--|----------------------------|---|---|----------------------------|
| Week                | Specific Learning Outcomes                                     | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| 15                  | 3.9 Solve simple inventory problems using the model met in 3.8 | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

**Assessment:** Give details of assignments to be used:  
Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 421)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 50            |
| Test               | At least 2 progress tests for feed back.                          | 20            |
| Practical          | At least 7 homeworks to be assessed by the teacher                | 30            |
| Total              |   | 100           |

**Recommended Textbooks & References:**

An Introduction to Management Science, D. R. Anderson, D. J. Sweeney, T. A. Williams

Operations Research, H. A. Taha

## Course: DEMOGRAPHY II

|  |                             |                     |                      |
|--|-----------------------------|---------------------|----------------------|
| <b>Programme: Statistics (Higher National Diploma)</b>   |                             |                     |                      |
| <b>Course: Demography II</b>   | <b>Course Code: STA 422</b> | <b>Total Hours:</b> | <b>5</b>             |
| <b>Year: 2</b>   | <b>Pre-requisite:</b>       | <b>Theoretical:</b> | <b>2 hours /week</b> |
| <b>Semester: 4</b>   |                             | <b>Practical:</b>   | <b>3 hours /week</b> |
| <b>Goal:</b> This course is designed to give the student a better understanding of population statistics.  |                             |                     |                      |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:  |                             |                     |                      |
| <ol style="list-style-type: none"><li>1. Understand the methods of evaluating demographic data.</li><li>2. Understand the methods of adjusting demographic data.</li><li>3. Understand the basic measures of fertility.</li><li>4. Understand the basic measures of mortality.</li><li>5. Understand life tables and their construction.</li><li>6. Understand reproductivity.</li><li>7. Understand the basic measures of migration.</li><li>8. Understand population estimates and projections.</li><li>9. Understand methods of estimating demographic measures from incomplete data.</li></ol> |                             |                     |                      |

| Theoretical Content   |   |  |   | Practical Content   |   |   |
|---|---|--|---|---|---|---|
| Week  | Specific Learning Outcomes  | Teacher's activities                     | Resources                                       | Specific Learning Outcomes  | Teacher's activities  | Resources                                       |
| <b>General Objective 1 (STA 422): Understand the methods of evaluating demographic data</b> |   |  |   |   |   |   |
| 1   | 1.1 Compute and interpret Whipple's index of digit preference<br><br>1.2 Compute and interpret Meyer's blended index of digit preference<br><br>1.3 Evaluate demographic data using the age-ratio method<br><br>1.4 Evaluate demographic data using the sex-ratio method<br><br>1.5 Compute and interpret the age-sex accuracy index. | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes<br><br>Life data | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes<br><br>Life data |
| <b>General Objective 2 (STA 422): Understand the methods of adjusting demographic data</b>  |   |  |   |   |   |   |
| 2   | 2.1 Adjust age data using the Carrier-Farrao ratio method<br><br>2.2 Adjust age-sex data using Newton's quadratic method  | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes<br><br>Life data | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes<br><br>Life data |
| <b>General Objective 3 (STA 422): Understand the basic method of fertility</b>              |   |  |   |   |   |   |
| 3   | 3.1 Compute and interpret crude birth rate, general fertility rate and child-woman ratio<br><br>3.2 State the advantages and disadvantages of measures in 3.1 above   | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes<br><br>Life data | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes<br><br>Life data |

| Theoretical Content   |  |  |               | Practical Content   |   |               |
|---|--|--|---------------|---|---|---------------|
| Week  | Specific Learning Outcomes   | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources     |
| 4   | 3.3 Compute and interpret age-specific fertility rate and mean age at birth  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 3.4 Relate the measures in 3.3 above to the age pattern of fertility   |  | Lecture Notes |   |   | Lecture Notes |
|   | 3.5 Explain fertility trends and differentials   |  | Life data     |   |   | Life data     |
| <b>General Objective 4 (STA 422): Understand the basic measures of mortality</b>    |  |  |               |   |   |               |
| 5   | 4.1 Explain cause-of-death surveys   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 4.2 Compute and interpret crude death rate and rate by age and sex   |  | Lecture Notes |   |   | Lecture Notes |
|   | 4.3 Compute and interpret infant mortality rate, neo-natal mortality rate, post neo-natal mortality rate and maternal mortality rate |  | Life data     |   |   | Life data     |
| 6   | 4.4 State the advantages and disadvantages of rates met in 4.2 and 4.3   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 4.5 Explain mortality differentials, trends and concept of demographic transition  |  | Lecture Notes |   |   | Lecture Notes |
|   |  |  | Life data     |   |   | Life data     |
| <b>General Objective 5 (STA 422): Understand life tables and their construction</b> |  |  |               |   |   |               |
| 7   | 5.1 Construct life tables using Reed-Merrel and Coale-Dmeny methods  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 5.2 Interpret the various life table functions   |  | Lecture Notes |   |   | Lecture Notes |
|   |  |  | Life data     |   |   | Life data     |

| Theoretical Content  |   |  |               | Practical Content   |   |               |
|--|---|--|---------------|---|---|---------------|
| Week   | Specific Learning Outcomes  | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources     |
| 8  | 5.3 Compute and interpret life table survival ratios  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|  | 5.4 Explain the use of model life tables for demographic estimation and projection                        |  | Lecture Notes |   |   | Lecture Notes |
|  |   |  | Life data     |   |   | Life data     |
| <b>General Objective 6 (STA 422): Understand reproductivity</b>                  |   |  |               |   |   |               |
| 9  | 6.1 Compute and interpret gross reproduction rate and net reproduction rate                               | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|  | 6.2 Compute and interpret a replacement index   |  | Lecture Notes |   |   | Lecture Notes |
|  |   |  | Life data     |   |   | Life data     |
| <b>General Objective 7 (STA 422): Understand the basic measures of migration</b> |   |  |               |   |   |               |
| 10   | 7.1 Define the concepts of immigration and emigration   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|  | 7.2 Distinguish between immigration and emigration  |  | Lecture Notes |   |   | Lecture Notes |
|  | 7.3 Compute and interpret immigration rate, emigration rate, gross migration rate and net gross migration |  | Life data     |   |   | Life data     |
| 11   | 7.4 Estimate net migration using the intercensal component method   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|  | 7.5 Estimate net migration using the intercensal cohort-component method                                  |  | Lecture Notes |   |   | Lecture Notes |
|  |   |  | Life data     |   |   | Life data     |

| Theoretical Content   |   |  |               | Practical Content   |   |               |
|---|---|--|---------------|---|---|---------------|
| Week  | Specific Learning Outcomes  | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources     |
| <b>General Objectives 8 (STA 422): Understand population estimates and projections</b>                            |   |  |               |   |   |               |
| 12  | 8.1 Compute and interpret arithmetic, geometric and exponential growth rates                                      | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 8.2 Project total population using the rates in 8.1   |  | Lecture Notes |   |   | Lecture Notes |
|   |   |  | Life data     |   |   | Life data     |
| 13  | 8.3 Explain population growth models such as quadratic, exponential, modified exponential, Gompertz, logistic etc | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 8.4 Fit the models in 8.3 to population figures and make estimates  |  | Lecture Notes |   |   | Lecture Notes |
|   | 8.5 Explain population growth estimation surveys  |  | Life data     |   |   | Life data     |
| <b>General Objectives 9 (STA 422): Understand methods of estimating demographic measures from incomplete data</b> |   |  |               |   |   |               |
| 14  | 9.1 Estimate crude birth rate using the reverse survival method   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 9.2 Estimate crude death rate using the forward survival method   |  | Lecture Notes |   |   | Lecture Notes |
|   |   |  | Life data     |   |   | Life data     |
| 15  | 9.3 Estimate fertility by the Brass $P_1/P_2$ method  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 9.4 Estimate child mortality by the Brass $P_1/P_2$ method  |  | Lecture Notes |   |   | Lecture Notes |
|   | 9.5 Explain the use of prospective and retrospective surveys in demographic estimation                            |  | Life data     |   |   | Life data     |

**Assessment:** Give details of assignments to be used:

Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 422)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 50            |
| Test               | At least 2 progress tests for feed back.                          | 20            |
| Practical          | At least 7 homeworks to be assessed by the teacher                | 30            |
| Total              |   | 100           |

**Recommended Textbooks & References:**

## Course: NON-PARAMETRIC STATISTICS

|   |                             |                     |                      |
|---|-----------------------------|---------------------|----------------------|
| <b>Programme: Statistics (Higher National Diploma)</b>  |                             |                     |                      |
| <b>Course: Non-parametric Statistics</b>  | <b>Course Code: STA 423</b> | <b>Total Hours:</b> | <b>5</b>             |
| <b>Year: 2</b>  | <b>Pre-requisite:</b>       | <b>Theoretical:</b> | <b>2 hours /week</b> |
| <b>Semester: 4</b>  |                             | <b>Practical:</b>   | <b>3 hours /week</b> |
| <b>Goal:</b> This course is designed to enable the student to understand non-parametric statistics.   |                             |                     |                      |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:   |                             |                     |                      |
| <ol style="list-style-type: none"><li>1. Understand non-parametric testing.</li><li>2. Understand a one sample of test of goodness of fit</li><li>3. Understand a two sample test for related samples.</li><li>4. Understand a two sample test for independent samples.</li></ol> |                             |                     |                      |

| Theoretical Content  |  |  |                            | Practical Content   |   |                            |
|--|--|--|----------------------------|---|---|----------------------------|
| Week   | Specific Learning Outcomes   | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| <b>General Objective 1 (STA 423): Understand non-parametric testing</b>                  |  |  |                            |   |   |                            |
| 1  | 1.1 Explain distribution-free methods of statistics                                    | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 2  | 1.2 State advantages of non-parametric statistical methods                             | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 3  | 1.3 State disadvantages of non-parametric statistical methods                          | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 2 (STA 423): Understand a one sample of test of goodness of fit</b> |  |  |                            |   |   |                            |
| 4  | 2.1 Explain the binomial test<br>2.2 Explain the $\chi^2$ one sample test              | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 5  | 2.3 Explain the one-sample runs test<br>2.4 Explain Kolmogorov-Smirnov goodness of fit | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 6  | 2.5 Evaluate examples using the tests met in 2.2 -2.4                                  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 3 (STA 423): Understand a two sample test for related samples</b>   |  |  |                            |   |   |                            |
| 7  | 3.1 Explain the use of the sign test and the condition underlying the test             | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

| Theoretical Content  |  |  |                            | Practical Content   |   |                            |
|--|--|--|----------------------------|---|---|----------------------------|
| Week   | Specific Learning Outcomes   | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| 8  | 3.2 Explain the method of the sign test including ties   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 9  | 3.3 Apply the sign test to solve problems  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 10   | 3.4 State the rationale and method of the Wilcoxon matched pairs signed rank test<br><br>3.5 Apply the Wilcoxon tests for independent samples  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 4 (STA 423): Understand a two sample test for independent samples</b> |  |  |                            |   |   |                            |
| 11   | 4.1 Define the median test<br><br>4.2 Explain the rationale and method of the median test  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 12   | 4.3 Define the Mann-Whitney V-test<br><br>4.4 Demonstrate the media test with examples   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 13   | 4.5 Explain the rationale and methods of V-test<br><br>4.6 Define the Kologorov-Smirnov two samples test<br><br>4.7 Explain the rationale of the Kolmogorov-Smirnov two samples test | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

| Theoretical Content |  |  |               | Practical Content   |   |               |
|---------------------|--|--|---------------|---|---|---------------|
| Week                | Specific Learning Outcomes                                 | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources     |
| 14                  | 4.8 Apply the test in 4.6 above to small and large samples | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|                     | 4.9 Define the runs test function and method               |  | Lecture Notes |   |   | Lecture Notes |
| 15                  | 4.10 Apply the runs test to small and large samples        | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|                     | 4.11 Explain the rationale and methods of the test         |  | Lecture Notes |   |   | Lecture Notes |

**Assessment:** Give details of assignments to be used:

Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 423)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 60            |
| Test               | At least 2 progress tests for feed back.                          | 20            |
| Practical          | At least 5 homeworks to be assessed by the teacher                | 20            |
| Total              |   | 100           |

**Recommended Textbooks & References:**

## Course: STATISTICAL COMPUTING

|   |                             |                     |                      |
|---|-----------------------------|---------------------|----------------------|
| <b>Programme: Statistics (Higher National Diploma)</b>  |                             |                     |                      |
| <b>Course: Statistical Computing</b>  | <b>Course Code: STA 424</b> | <b>Total Hours:</b> | <b>5</b>             |
| <b>Year: 2</b>  | <b>Pre-requisite:</b>       | <b>Theoretical:</b> | <b>2 hours /week</b> |
| <b>Semester: 4</b>  |                             | <b>Practical:</b>   | <b>3 hours /week</b> |
| <b>Goal:</b> This course is designed to enable the student to understand the application of computers in statistics.  |                             |                     |                      |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:   |                             |                     |                      |
| <ol style="list-style-type: none"><li>1. Understand random numbers and methods of generating them.</li><li>2. Understand numerical methods of solving equations.</li><li>3. Understand how to solve matrix equations by numerical methods.</li><li>4. Understand the basic concepts of kernel-based probability density estimation.</li><li>5. Understand forming statistical algorithms.</li></ol> |                             |                     |                      |

| Theoretical Content  |   |  |               | Practical Content   |   |           |
|--|---|--|---------------|---|---|-----------|
| Week   | Specific Learning Outcomes  | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources |
| <b>General Objective 1 (STA 424): Understand random numbers and methods of generating them</b> |   |  |               |   |   |           |
| 1  | 1.1 Define a random number  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks |
|  | 1.2 Define a pseudo-random number   |  | Lecture Notes |   |   |           |
|  | 1.3 State the properties of random numbers  |  |               |   |   |           |
|  | 1.4 State the uses of random numbers  |  |               |   |   |           |
|  | 1.5 Identify various methods of generating random numbers                                   |  |               |   |   |           |
| 2  | 1.6 Explain the higher congruential methods of generating random numbers                    | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks |
|  | 1.7 Define a random number generator  |  | Lecture Notes |   |   |           |
|  | 1.8 Identify various random number generators   |  |               |   |   |           |
| 3  | 1.9 Generate random numbers from various distributions using the generators in 1.8          | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks |
|  | 1.10 Perform statistical test for random numbers eg. goodness of fit and independence tests |  | Lecture Notes |   |   |           |
| <b>General Objective 2 (STA 424): Understand numerical methods of solving equations</b>        |   |  |               |   |   |           |
| 4  | 2.1 Explain the need for numerical solutions of equations                                   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks |
|  | 2.2 Evaluate by graphical methods the roots of equations                                    |  | Lecture Notes |   |   |           |
|  | 2.3 Evaluate by direct iteration processes, the roots of equations                          |  |               |   |   |           |

| Theoretical Content  |  |  |                            | Practical Content   |   |                            |
|--|--|--|----------------------------|---|---|----------------------------|
| Week   | Specific Learning Outcomes   | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| 5  | 2.4 Evaluate by bisection methods, the roots of an equation                        | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
|  | 2.5 State and explain the regular Falsi formula for finding the roots of equations |  |                            |   |   |                            |
|  | 2.6 State and explain Aitkin's formula for finding the roots of equations          |  |                            |   |   |                            |
| 6  | 2.7 State and derive the Newton- Raphson formula                                   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
|  | 2.8 Apply 2.2 to 2.7 to solve problems   |  |                            |   |   |                            |
|  | 2.9 Compare the efficiency and accuracy of 2.3 to 2.7                              |  |                            |   |   |                            |
| <b>General Objective 3 (STA 424): Understand how to solve matrix equations by numerical methods</b>                |  |  |                            |   |   |                            |
| 7  | 3.1 Define an orthogonal matrix  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
|  | 3.2 Apply matrix methods for orthogonalisation                                     |  |                            |   |   |                            |
|  | 3.3 Decompose a matrix into triangular and diagonal forms                          |  |                            |   |   |                            |
|  | 3.4 Apply Jacobi's method to the solution of matrices in the form 3.3              |  |                            |   |   |                            |
| 8  | 3.5 Review eigen values and eigen vectors methods                                  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
|  | 3.6 Apply numerical methods to determine eigen vectors and eigen values            |  |                            |   |   |                            |
|  | 3.7 Evaluate the inverse of a matrix   |  |                            |   |   |                            |
| <b>General Objective 4 (STA 424): Understand the basic concepts of kernel-based probability density estimation</b> |  |  |                            |   |   |                            |
| 9  | 4.1 Explain the need for probability density estimation                            | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
|  | 4.2 State the various type of kernel functions                                     |  |                            |   |   |                            |
|  | 4.3 State the properties of kernel functions                                       |  |                            |   |   |                            |

| Theoretical Content   |  |  |                            | Practical Content   |   |                            |
|---|--|--|----------------------------|---|---|----------------------------|
| Week  | Specific Learning Outcomes   | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| 10  | 4.4 Explain the use of a smoothing parameter   | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 4.5 Define a kernel-based probability density estimation   |  | Lecture Notes              |   |   | Lecture Notes              |
| 11  | 4.6 Check the assumption of independence in the given sample   | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 4.7 Estimate the unknown probability density function from a given sample  |  | Lecture Notes              |   |   | Lecture Notes              |
| <b>General Objective 5 (STA 424): Understand forming statistical algorithms</b> |  |  |                            |   |   |                            |
| 12  | 5.1 Introduce the writing of flow charts   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 13  | 5.2 Define statistical algorithms  | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 5.3 Write flow charts for statistical algorithms for sums, squares and products  |  | Lecture Notes              |   |   | Lecture Notes              |
|   | 5.4 Write flow charts for statistical algorithms to generate random samples from: exponential, poisson, chi-square, weibull and normal distributions |  |                            |   |   |                            |
| 14  | 5.5 Write flow charts for statistical algorithms for serial correlation coefficient and log  | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 5.6 Write flow charts for a statistical algorithm for Kolmogorov-Smirnov one sample test   |  | Lecture Notes              |   |   | Lecture Notes              |
| 15  | 5.7 Write flow charts for statistical algorithms to test for randomness  | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 5.8 Apply algorithms to multiway tables  |  | Lecture Notes              |   |   | Lecture Notes              |

**Assessment:** Give details of assignments to be used:  
Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| <b>Type of Assessment</b> | <b>Purpose and Nature of Assessment (STA 424)</b>                 | <b>Weighting (%)</b> |
|---------------------------|---|----------------------|
| Examination               | Final Examination (written) to assess knowledge and understanding | 50                   |
| Test                      | At least 2 progress tests for feed back.                          | 20                   |
| Practical                 | At least 7 homeworks to be assessed by the teacher                | 30                   |
| Total                     |   | 100                  |

**Recommended Textbooks & References:**

## Course: TIME SERIES ANALYSIS

|   |                             |                     |                      |
|---|-----------------------------|---------------------|----------------------|
| <b>Programme: Statistics (Higher National Diploma)</b>  |                             |                     |                      |
| <b>Course: Time Series Analysis</b>   | <b>Course Code: STA 425</b> | <b>Total Hours:</b> | <b>5</b>             |
| <b>Year: 2</b>  | <b>Pre-requisite:</b>       | <b>Theoretical:</b> | <b>2 hours /week</b> |
| <b>Semester: 4</b>  |                             | <b>Practical:</b>   | <b>3 hours /week</b> |
| <b>Goal:</b> This course is designed to develop the student's ability to analyse time series data and use its techniques for forecasting.   |                             |                     |                      |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:   |                             |                     |                      |
| <ol style="list-style-type: none"><li>1. Understand the meaning and importance of time series analysis.</li><li>2. Understand autoregressive models.</li><li>3. Understand serial correlation.</li><li>4. Understand the application of Fourier analysis to spectral theory.</li><li>5. Understand periodogram analysis.</li><li>6. Understand a correlogram.</li></ol> |                             |                     |                      |

| Theoretical Content   |   |  |               | Practical Content   |   |               |
|---|---|--|---------------|---|---|---------------|
| Week  | Specific Learning Outcomes  | Teacher's activities                     | Resources     | Specific Learning Outcomes  | Teacher's activities  | Resources     |
| <b>General Objective 1 (STA 425): Understand the meaning and importance of time series analysis</b> |   |  |               |   |   |               |
| 1   | 1.1 Define a time series  | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 1.2 Illustrate time series data with examples                         |  | Lecture Notes |   |   | Lecture Notes |
|   | 1.3 Plot time series data graphically                                 |  |               |   |   |               |
| 2   | 1.4 Explain the components of time series                             | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 1.5 Explain moving averages   |  | Lecture Notes |   |   | Lecture Notes |
| 3   | 1.6 State the importance of moving averages in time series analysis   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 1.7 Evaluate the trend using moving average and least squares methods |  | Lecture Notes |   |   | Lecture Notes |
| <b>General Objective 2 (STA 425): Understand autoregressive models</b>                              |   |  |               |   |   |               |
| 4   | 2.1 Define autoregressive models                                      | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 2.2 Derive the first and second order of autoregressive models        |  | Lecture Notes |   |   | Lecture Notes |
| 5   | 2.3 Compute the estimates of the parameters of the models in 2.2      | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 2.4 Carry out the residual analysis of autoregressive models          |  | Lecture Notes |   |   | Lecture Notes |
| <b>General Objective 3 (STA 425): Understand serial correlation</b>                                 |   |  |               |   |   |               |
| 6   | 3.1 Define serial correlation   | Explain and discuss the concepts covered | Textbooks     | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks     |
|   | 3.2 Identify the sources and consequences of autocorrelation          |  | Lecture Notes |   |   | Lecture Notes |

| Theoretical Content   |   |  |                            | Practical Content   |   |                            |
|---|---|--|----------------------------|---|---|----------------------------|
| Week  | Specific Learning Outcomes  | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| 7   | 3.3 Define peaks, troughs and periods   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 8   | 3.4 Determine the period in time series   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 4 (STA 425): Understand the application of Fourier analysis to spectral theory</b> |   |  |                            |   |   |                            |
| 9   | 4.1 Explain Fourier analysis<br>4.2 Define spectral density                         | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 10  | 4.3 Identify spectral density in moving average and autoregressive series           | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 11  | 4.4 Plot spectral density for moving averages and autoregressive series             | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 5 (STA 425): Understand periodogram analysis</b>                                   |   |  |                            |   |   |                            |
| 12  | 5.1 Define a periodogram<br>5.2 Construct a periodogram for autoregressive analysis | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 13  |   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

| Theoretical Content  |  |  |                            | Practical Content   |   |                            |
|--|--|--|----------------------------|---|---|----------------------------|
| Week   | Specific Learning Outcomes                                     | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| <b>General Objective 6 (STA 425): Understand a correlogram</b> |  |  |                            |   |   |                            |
| 14   | 6.1 Describe a correlogram                                     | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|  | 6.2 Define a correlogram                                       |  | Lecture Notes              |   |   | Lecture Notes              |
| 15   | 6.3 State the importance of correlograms and spectral analysis | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |

**Assessment:** Give details of assignments to be used:

Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 425)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 60            |
| Test               | At least 2 progress tests for feed back.                          | 20            |
| Practical          | At least 5 homeworks to be assessed by the teacher                | 20            |
| Total              |   | 100           |

**Recommended Textbooks & References:**

Statistical Forecasting, W. G. Gilchrist

## Course: MULTIVARIATE METHODS AND STOCHASTIC PROCESSES

|  |                       |                             |                       |
|--|-----------------------|-----------------------------|-----------------------|
| <b>Programme: Statistics (Higher National Diploma)</b>   |                       |                             |                       |
| <b>Course: Multivariate Methods and Stochastic Processes</b>   |                       | <b>Course Code: STA 426</b> | <b>Total Hours: 5</b> |
| <b>Year: 2</b>   | <b>Pre-requisite:</b> | <b>Theoretical:</b>         | <b>2 hours /week</b>  |
| <b>Semester: 4</b>   |                       | <b>Practical:</b>           | <b>3 hours /week</b>  |
| <b>Goal:</b> This course is designed to enable the student to understand multivariate methods and stochastic processes.  |                       |                             |                       |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:<br><br><ol style="list-style-type: none"><li>1. Understand distributions of two or more random variables.</li><li>2. Understand the multivariate normal distribution.</li><li>3. Understand the construction and use of discriminant analysis.</li><li>4. Understand principal component analysis.</li><li>5. Understand factor analysis.</li><li>6. Understand the use of Hotelling's <math>T^2</math> distribution.</li><li>7. Understand the basic concepts of stochastic processes.</li><li>8. Understand a Markov process.</li><li>9. Understand the basic concepts of a poisson process.</li><li>10. Understand the basic concepts of birth and death processes.</li></ol> |                       |                             |                       |

| Theoretical Content  |  |  |                                | Practical Content   |   |                                |
|--|--|--|--------------------------------|---|---|--------------------------------|
| Week   | Specific Learning Outcomes   | Teacher's activities                     | Resources                      | Specific Learning Outcomes  | Teacher's activities  | Resources                      |
| <b>General Objective 1 (STA 426): Understand distributions of two or more random variables</b>     |  |  |                                |   |   |                                |
| 1  | 1.1 Define the joint function of two or more variables<br><br>1.2 Obtain marginal and conditional distributions of multivariate distributions<br><br>1.3 Define the cumulative distribution function of distribution of two or more variables.                   | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes |
| <b>General Objective 2 (STA 426): Understand the multivariate normal distribution</b>              |  |  |                                |   |   |                                |
| 2  | 2.1 Define the multivariate normal distribution<br><br>2.2 Evaluate the expected value of the distribution met in 2.1  | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes |
| 3  | 2.3 Obtain the marginal distributions of the multivariate normal distribution<br><br>2.4 Evaluate the distribution of linear combinations of normally distributed variables<br><br>2.5 Obtain conditional distributions of normally distributed random variables | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes |
| <b>General Objective 3 (STA 426): Understand the construction and use of discriminant analysis</b> |  |  |                                |   |   |                                |
| 4  | 3.1 Explain discriminant analysis<br><br>3.2 Define Fisher's linear discriminant function (FLDF)   | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes |
| 5  | 3.3 Apply the function in 3.2 to solve problems  | Explain and discuss the concepts covered | Textbooks<br><br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br><br>Lecture Notes |

| Theoretical Content   |   |  |                            | Practical Content   |   |                            |
|---|---|--|----------------------------|---|---|----------------------------|
| Week  | Specific Learning Outcomes  | Teacher's activities                     | Resources                  | Specific Learning Outcomes  | Teacher's activities  | Resources                  |
| <b>General Objective 4 (STA 426): Understand principal component analysis</b>                         |   |  |                            |   |   |                            |
| 6   | 4.1 Define the population principal components  | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 4.2 Define sample principal components  |  | Lecture Notes              |   |   | Lecture Notes              |
| 7   | 4.3 Apply the principal components to solve problems  | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 5 (STA 426): Understand factor analysis</b>                                      |   |  |                            |   |   |                            |
| 8   | 5.1 Explain factor analysis   | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 5.2 Explain factor loading  |  | Lecture Notes              |   |   | Lecture Notes              |
| 9   | 5.3 Apply factor analysis to solve problems   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 6 (STA 426): Understand the use of Hotelling's <math>T^2</math> distribution</b> |   |  |                            |   |   |                            |
| 10  | 6.1 Define Hotelling's $T^2$ Distribution   | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| 11  | 6.2 Apply $T^2$ statistics to solve problems e.g. testing the hypothesis about, and obtaining confidence region of, the mean vector | Explain and discuss the concepts covered | Textbooks<br>Lecture Notes | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks<br>Lecture Notes |
| <b>General Objective 7 (STA 426): Understand the basic concepts of stochastic processes</b>           |   |  |                            |   |   |                            |
| 12  | 7.1 Define a stochastic processes   | Explain and discuss the concepts covered | Textbooks                  | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks                  |
|   | 7.2 Give examples of stochastic processes   |  | Lecture Notes              |   |   | Lecture Notes              |

| Theoretical Content   |   |   |   | Practical Content   |   |   |
|---|---|---|---|---|---|---|
| Week  | Specific Learning Outcomes                                      | Teacher's activities                                | Resources   | Specific Learning Outcomes  | Teacher's activities  | Resources   |
| <b>General Objective 8 (STA 426): Understand a Markov process</b>                                 |   |   |   |   |   |   |
| 13  | 8.1 Explain a Markov process                                    | Explain and discuss the concepts covered            | Textbooks   | Demonstrate understanding of the concepts covered by solving examples | Explain and supervise student exercises and assess student work | Textbooks   |
|   | 8.2 Define Markov chains  |   | Lecture Notes                                       |   |   | Lecture Notes                                       |
|   | 8.3 Give examples of Markov chains                              |   |   |   |   |   |
| <b>General Objective 9 (STA 426): Understand the basic concepts of a poisson process</b>          |   |   |   |   |   |   |
| 14  | 9.1 Define a poisson process                                    | Understand basic concept of birth and death process | Understand basic concept of birth and death process | Understand basic concept of birth and death process                   | Understand basic concept of birth and death process             | Understand basic concept of birth and death process |
|   | 9.2 Give examples of poisson processes                          |   |   |   |   |   |
| <b>General Objective 10 (STA 426): Understand the basic concepts of birth and death processes</b> |   |   |   |   |   |   |
| 15  | 10.1 Define a simple birth and death process                    | Understand basic concept of birth and death process | Understand basic concept of birth and death process | Understand basic concept of birth and death process                   | Understand basic concept of birth and death process             | Understand basic concept of birth and death process |
|   | 10.2 State examples of simple birth and death process           |   |   |   |   |   |
|   | 10.3 Define the mean and variance for birth and death processes |   |   |   |   |   |

**Assessment:** Give details of assignments to be used:  
Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 426)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 60            |
| Test               | At least 2 progress tests for feed back.                          | 20            |
| Practical          | At least 5 homeworks to be assessed by the teacher                | 20            |
| Total              |   | 100           |

**Recommended Textbooks & References:**

## Course: PROJECT

|  |                             |  |  |
|--|-----------------------------|--|--|
| <b>Programme: Statistics (Higher National Diploma)</b>   |                             |  |  |
| <b>Course: Project</b>   | <b>Course Code: STA 427</b> | <b>Total Hours:</b>                      | <b>5</b>                                     |
| <b>Year: 2</b><br><b>Semester: 4</b>   | <b>Pre-requisite:</b>       | <b>Theoretical:</b><br><b>Practical:</b> | <b>0 hours /week</b><br><b>5 hours /week</b> |
| <b>Goal:</b> This course is designed to enable the student to undertake an individual project and write a report on it.  |                             |  |  |
| <b>General Objectives:</b> On completion of this course, the diplomate should be able to:<br><br><ol style="list-style-type: none"><li>1. Research a chosen topic at HND level from available sources.</li><li>2. Collect data on the chosen topic.</li><li>3. Produce a report on the chosen topic.</li></ol> |                             |  |  |

| Theoretical Content  |   |   |  | Practical Content                   |   |  |
|--|---|---|--|-------------------------------------|---|--|
| Week   | Specific Learning Outcomes                                      | Teacher's activities                          | Resources                              | Specific Learning Outcomes          | Teacher's activities                          | Resources                              |
| <b>General Objective 1 (STA 427): Research a chosen topic at HND level from available sources.</b> |   |   |  |                                     |   |  |
| 1  | 1.1 Choose, under guidance, an appropriate topic of interest.   | Provide guidance in finding suitable topics.  | Textbooks<br>Lecture Notes<br>Internet | Selection of a topic of interest.   | Provide guidance in finding suitable topics.  | Textbooks<br>Lecture Notes<br>Internet |
| 2  | 1.2 Research a chosen topic from available sources.             | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet | Demonstrate research ability        | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet |
| 3  | 1.2 (continued) Research a chosen topic from available sources. | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet | Demonstrate research ability        | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet |
| 4  | 1.2 (continued) Research a chosen topic from available sources. | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet | Demonstrate research ability        | Provide guidance in finding suitable sources. | Textbooks<br>Lecture Notes<br>Internet |
| <b>General Objective 2 (STA 427): Collect data on the chosen topic.</b>                            |   |   |  |                                     |   |  |
| 5  | 2.1 Collect data on the chosen topic from available sources.    | Provide guidance in collecting data           | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability to collect data | Provide guidance in collecting data.          | Textbooks<br>Lecture Notes<br>Internet |

| Theoretical Content   |  |                                     |  | Practical Content                     |                                      |  |
|---|--|-------------------------------------|--|---------------------------------------|--------------------------------------|--|
| Week  | Specific Learning Outcomes   | Teacher's activities                | Resources                              | Specific Learning Outcomes            | Teacher's activities                 | Resources                              |
| 6   | 2.1 (continued) Collect data on the chosen topic from available sources  | Provide guidance in collecting data | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability to collect data   | Provide guidance in collecting data. | Textbooks<br>Lecture Notes<br>Internet |
| 7   | 2.1 (continued) Collect data on the chosen topic from available sources. | Provide guidance in collecting data | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability to collect data   | Provide guidance in collecting data. | Textbooks<br>Lecture Notes<br>Internet |
| 8   | 2.1 (continued) Collect data on the chosen topic from available sources. | Provide guidance in collecting data | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability to collect data   | Provide guidance in collecting data. | Textbooks<br>Lecture Notes<br>Internet |
| 9   | 2.1 (continued) Collect data on the chosen topic from available sources. | Provide guidance in collecting data | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability to collect data   | Provide guidance in collecting data. | Textbooks<br>Lecture Notes<br>Internet |
| <b>General Objective 3 (STA 427): Produce a report on the chosen topic.</b> |  |                                     |  |                                       |                                      |  |
| 10  | 3.1 Produce a report on the chosen topic.                                | Provide guidance in report writing  | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing   | Textbooks<br>Lecture Notes<br>Internet |

| Theoretical Content |   |                                    |  | Practical Content                     |                                    |  |
|---------------------|---|------------------------------------|--|---------------------------------------|------------------------------------|--|
| Week                | Specific Learning Outcomes                            | Teacher's activities               | Resources                              | Specific Learning Outcomes            | Teacher's activities               | Resources                              |
| 11                  | 3.1 (continued) Produce a report on the chosen topic. | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet |
| 12                  | 3.1 (continued) Produce a report on the chosen topic. | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet |
| 13                  | 3.1 (continued) Produce a report on the chosen topic. | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet |
| 14                  | 3.1 (continued) Produce a report on the chosen topic. | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet |
| 15                  | 3.1 (continued) Produce a report on the chosen topic. | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet | Demonstrate ability in report writing | Provide guidance in report writing | Textbooks<br>Lecture Notes<br>Internet |

**Assessment:** Give details of assignments to be used:

Coursework/ Assignments %; Course test %; Practical %; Projects %; Examination %

| Type of Assessment | Purpose and Nature of Assessment (STA 427)                        | Weighting (%) |
|--------------------|---|---------------|
| Examination        | Final Examination (written) to assess knowledge and understanding | 0             |
| Test               | 0 progress tests  | 0             |
| Practical          | Report of 20 - 30 pages length                                    | 100           |
| Total              |   | 100           |

**Recommended Textbooks & References:**