School of Business
General Education – Core Requirements – Numeracy Category

1. **COURSE TITLE**: BUSINESS NUMERACY

2. **COURSE CODE**: GCNU1036

3. **NO. OF UNITS**: 3 (3, 3, 0)

4. **OFFERING DEPARTMENT**

   Department of Finance and Decision Sciences, School of Business
   Course Coordinator - Dr. WONG, Tony C K

5. **AIMS & OBJECTIVES**

   Crucial to business success, numerical methods are often viewed as too complex to understand, much less use. They are, in fact, far less complicated, able to be broken down into step-by-step instructions and processed by basic computing devices. This course simplifies and demystifies the numbers game, illustrating just how straightforward—and relatively easy—it really is.

   Taking you clearly and concisely through numerous fundamental functions, both elementary and advanced, this course arms you with the tools necessary to not only approach numbers with more confidence, but solve business numeracy problems more easily, analyze information more accurately, and make decisions more effectively.

   Quantitative writing assignments (Topic example: Understanding how economic indicators, market share, market price, share prices, manufacturing costs, financial ratios, volume of units produced, profit margins, cost of living indexes, demographic data, median home prices, supply and demand statistics have impacts on the business environment) in this course will enrich students ability of not just compute an answer, but provide an adventure for students to explore, to deduce and to draw conclusions based on numerical or other quantitative evidence.

   This numeracy course “bootcamp” gives students a toolkit of techniques to enable them to process figures with confidence. Using outcomes based learning and practical exercises, students will be competent and able to communicate effectively with numbers and to enhance their ability to criticize, reflect upon, and apply the skills in making decisions in business environment and daily life.
### 6. **Course Content**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Teaching Hours</th>
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</thead>
<tbody>
<tr>
<td><strong>1) Number Concepts in Business Environment</strong></td>
<td><strong>4 hours (10%)</strong></td>
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<tr>
<td>- Concepts and Variables</td>
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<tr>
<td>a) Difference between the concepts and variables</td>
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<tr>
<td>b) Ways of looking at data; Notation; Counting techniques</td>
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<tr>
<td>c) Types of variables</td>
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<tr>
<td>- From the viewpoint of causation</td>
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<td>- From the viewpoint of the study design</td>
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<tr>
<td>- From the viewpoint of the unit of measurement</td>
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<tr>
<td>- Encryption (<em>Data Transformation</em>)</td>
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<tr>
<td>a) the accuracy of the measurement</td>
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<tr>
<td>b) the appropriateness of the measurements</td>
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<tr>
<td>c) the inadequacy for the measurements</td>
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<tr>
<td>d) the information lost in the process of data transformation.</td>
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<tr>
<td>(for example, Samuel Johnson said that, “Round numbers are always false!”)</td>
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<td>e) the meanings encrypted within the numbers?</td>
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<tr>
<td>- Interest Rate, Exchange Rate and Inflation</td>
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</table>

| **2) Business Indicators** | **8 hours (20%)** |
| - Concept of business indicator | |
| Business indicators is a set of criteria reflective of the concept which can then be converted into variables | |
| - Economic and Social indicators | |
| - Financial indicators | |
| - Market and Industrial Information | |
| - Operationalization of Indicators | |
| Theories and Methods used by Agents (For examples: Statistics Bureaus and Stock Exchanges in different countries; Global organizations like OECD, WTO; and other research organizations) that producing Business Indicators | |
Sample of the examples used to illustrate operationalization of the indicators

Example:

**Concept**: Poverty  
**Variables**: individual income, household income, measurement of welfare, measurement of poverty line, ... etc  
**Indicator**: Gini coefficient.

**Concept**: Hong Kong Stock Market Performance  
**Variables**: stock price, number of issues, classification of industry, measurement of stock closing price, measurement of weighted index, ... etc  
**Indicator**: Hang Seng Index.

Gini coefficient and Hang Seng Index to illustrate the approaches, techniques and operationalization of indicators. And in Topic 4, the quantitative writing exercises will provide the chance for students to experience the whole process for a problem of their interests so that they can “model” their own indicator to “solve” the problem for meaningful information.

Since there are so many methods and potential numeracy problems, it is impossible to cross-reference them all. We will demonstrate by examples and provide assistance to students in carrying out the work. Some basic concepts will be delivered in this topic. Apart from this, we will also invite people from those agents to deliver/share real-life examples to our students.

3) Analysis and Interpretation of Business Numbers

In numeracy, we sometimes sit silently in thought when analyzing data, we can also learn more by using a static visualization such as printed graphs. But now in the information age, we can interact with the data by using tools to visualize the information and to figure out what the information means.

- Standardization of data

8 hours (20%)
- Data Visualization and Visual Perception

- Quantitative Reasoning

  a) Steps in quantitative reasoning
     i. read and analyze data;
     ii. create models;
     iii. draw inferences;
     iv. support conclusions based on sound mathematical reasoning

  b) Concerns for quantitative reasoning
     i. the appropriateness of the mathematical model to solve problems;
     ii. presenting quantitative information - verbally, numerically, symbolically, and visually;
     iii. limitations of quantitative models.

- Wisdom in the age of information overloaded environment

4) Regression and Statistical Modeling

4.1 Understanding the relationship

  a) Linear Regression Model
     - Types of Regression Models and pattern analysis
     - Determining the Simple Linear Regression Equation
     - Assumptions and residual analysis
     - Correlation: Measuring the strength of association
     - Calculating the Simple Linear Regression Coefficients and Correlation Coefficient using Microsoft Excel
     - Pitfalls in Regression and Ethical issues
     - An introduction to Multiple Regression models

  b) Index Numbers and Time-Series Forecasting
     - The importance of Business Forecasting
     - Component Factors (Trend, Seasonal, Cyclical and Irregular) of Time Series Models

20 hours (50%)
- Smoothing of Time Series
- Least-Square Trend fitting and Forecasting
- Measuring Changes over time
- Index Numbers (examples: price indexes, quantity Indexes)
- Simple and weighted aggregate index
- Calculating changes, changing the base period
- Comparing indexes and Deflating an index
- Calculating Moving Average, Components Factors of Time Series Model, Least-Square Trend fitting and Forecasting, Index Numbers using Microsoft Excel
- Pitfalls Concerning Time Series Analysis and Index Numbers

**

4.1 extension 1) Analytical Interaction and Navigation

John W. Turkey and M.B. Wilk mentioned that “Data analysis, like experimentation, must be considered as an open-minded, highly interactive, iterative process, whose actual steps are selected segments of stubbly branching, tree-like pattern of possible actions.” Some methods of navigating through data are more effective than others.
- comparing values and patterns
- sorting the information according to different criteria
- adding variables into the analysis
- filtering the data to view the subset of the data
- highlighting a portion of the data
- aggregate and disaggregate information
- re-expressing the data
- re-scaling the data

4.1 extension 2) Analytical Techniques and Practices
(Approaches used in improving the effectiveness of visual analysis)

- How to use the quantitative scales (for examples, linear scale, logarithmic scales, time scale);
- reference line, region, point for presenting data;
- provide multiple concurrent views and brushing
4.1 extension 1 and 2 will be integrated into the teaching of 4.1 to illustrate how we can manipulate the data in regression analysis, time series and index number calculation in the business environment.

4.2 Quantitative writing of Business Numbers (See Appendix for approach of the quantitative writing assignment) Quantitative writing to numeracy problems

Steps of quantitative writing
a) Define the problem clearly
b) Identify the appropriate technique
c) Collect the necessary data
d) Develop a solution
e) Analysis the results
f) Iterate if necessary or implement the results

Sample of the examples** used to illustrate quantitative writing
Example: Exploring Economic Inequality using Gini coefficient?

Learning goals for this particular topic can be
a) How to measure income?
b) How to measure wealth?
c) What do we meant by inequality?
d) Do we need to adjust according to …?

Illustration of mathematical concepts and ideas to tackle future problems (Identify, model and solve) by the following

a) Definition of Gini Coefficient and Lorenz curve
b) Why this approach is a measurement of inequality?
c) Any other alternative measurements exist?
d) How individual countries calculate those figures?
e) Current situation in Hong Kong
f) How to use Excel to support the analysis?
Use the example to conduct a reflection with previous learning in this course

a) Topic 1 will deliver how we are going to measure the economic inequality
b) Topic 2 will further develop students’ critical thinking in understanding the meanings of the different measurements available.
c) Topic 3 will help them to collect, analyze and interpret the figures by using different techniques available
d) Topic 4 will help them to reflect on the appropriateness of the measurements and the relationship in establishing the measurements.

** We can also use other business numbers that students encountered a lot to teach them. (For examples, the Hang Seng Index, the GDP in Hong Kong, …) The selection will be based on the background of the students who take this course.

- Aptitudes and attitudes of effective quantitative writing
- The six basic principles of quantitative writing (Know your source, the whole story, based on what, from when to when, mandated changes and computational searching)

7. **COURSE INTENDED LEARNING OUTCOMES (CILOs)**

Upon successful completion of this course, students should be able to:

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Intended Learning Outcomes (CILOs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understand and appreciate the linkage between numeracy and business. [CLO2, CLO4]</td>
</tr>
<tr>
<td>2</td>
<td>Acquire practical numeracy skills that can be put to immediate use in the routine tasks of daily life and business decision. [CLO2, CLO3, CLO4]</td>
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<tr>
<td>3</td>
<td>Use appropriate tools to consolidate, revise and self-assess in numeracy. [CLO1, CLO3]</td>
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<tr>
<td>4</td>
<td>Understand key business metrics and apply intelligent numeric shortcuts to</td>
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</table>
describe, communicate and presenting the information. [CLO3, CLO4]

8. **TEACHING & LEARNING ACTIVITIES (TLAs)**

<table>
<thead>
<tr>
<th>CILO No.</th>
<th>TLAs</th>
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<tbody>
<tr>
<td>1, 4</td>
<td>Any least two Guest Talk will be delivered by practitioners from business indicators producing agent (For examples: Statistician from Census and Statistics Department; Officers from Hong Kong Stock Exchange, etc) to present the theories and methods they are using in producing business indicators. Students will be given Cases from various sources to discuss the processes in producing business indicators and its implications.</td>
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<tr>
<td>2, 3</td>
<td>Using some business indicators (For examples, the quarterly data relating to profits, inventories, sales, and wages and salaries in Hong Kong) to teach students the methods, the procedures, the validity and the quantity writing that report the results. Each Groups/Students (depend on the complexity of the suggested problem) will give a problem; they need to suggest an approach to produce an indicators or to write a quantitative report. They need to present this report to the class and the lecturer.</td>
</tr>
</tbody>
</table>

9. **ASSESSMENT METHODS (AMS)**

<table>
<thead>
<tr>
<th>Type of Assessment Methods</th>
<th>Weighting</th>
<th>CILOs to be addressed</th>
<th>Description of Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Participation and Discussion</td>
<td>30 %</td>
<td>1 - 4</td>
<td>Discussion of Quantitative Writing examples</td>
</tr>
<tr>
<td>Tests</td>
<td>20 %</td>
<td>1 - 4</td>
<td>At least one Quantitative writing assignment (See Appendix)</td>
</tr>
<tr>
<td>Assignments</td>
<td>50 %</td>
<td>1 - 4</td>
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</tbody>
</table>

10. **TEXTBOOKS / RECOMMENDED READINGS**


11. Alignment with the Intended Learning Outcomes of the GE Programme (PILOs)

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>PILO1</th>
<th>PILO2</th>
<th>PILO3</th>
<th>PILO4</th>
<th>PILO5</th>
<th>PILO6</th>
<th>PILO7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CILO1</td>
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<td>√</td>
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<tr>
<td>CILO2</td>
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<td>CILO3</td>
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<tr>
<td>CILO4</td>
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12. Alignment with the Intended Learning Outcomes of the GE Category (Cat-ILOs):

Single-discipline Numeracy (Category)

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Cat-ILO1</th>
<th>Cat-ILO2</th>
<th>Cat-ILO3</th>
<th>Cat-ILO4</th>
<th>Cat-ILO5 (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CILO1</td>
<td>√</td>
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<tr>
<td>CILO2</td>
<td></td>
<td>√</td>
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<td>CILO3</td>
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<tr>
<td>CILO4</td>
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Intended Learning Outcomes of the GE Programme (PILOs)

PILO1 Communicate effectively as speakers and writers in both English and Chinese;
PILO2 Access and manage complex information and problems using technologically appropriate means;
PILO3 Apply appropriate mathematical reasoning to address problems in everyday life;
PILO4 Acquire an active and healthy lifestyle;
PILO5 Use historical and cultural perspectives to gain insight into contemporary issues;
PILO6 Apply various value systems to decision-making in personal, professional, and social/political situations;
PILO7 Make connections among a variety of disciplines to gain insight into contemporary personal, professional, and community situations.

Intended Learning Outcomes of the GE Core Category (Cat-ILOs)

**Numeracy**

Cat-ILO1 Manipulate the tools of mathematics for exploring quantitative relationships;
Cat-ILO2 Demonstrate a broad numerical awareness;
Cat-ILO3 Apply mathematical reasoning to identify, model and solve relevant problems in our society;
Cat-ILO4 Understand and explain the interrelationships between everyday phenomena and mathematics
Quantitative Writing Assignment for Business Numeracy Course

Quantitative writing assignments differ both from "story problems" in numeracy courses and from writing assignments that lack a quantitative dimension. These assignments take a number of different forms and are characterized by some or all of the following features.

- Quantitative writing generally presents students with an "ill-structured" problem requiring the analysis of quantitative data in an ambiguous context without a clear right answer. Unlike a numeracy "story problem," which is usually a "well-structured" problem with a right answer, a QW assignment requires students to formulate a claim for a best solution and support it with reasons and evidence.

- Unlike the writing assignments that students are typically used to, QW assignments require students to analyze and interpret quantitative data. Writers must use numbers in a variety of ways to help them define a problem, to see alternative points of view, to speculate about causes and effects, and to create evidence-based arguments. Often they must learn to construct and reference their own tables or graphs.

- Quantitative writing forces students to contemplate the meaning of numbers, to understand where the numbers come from and how they are presented. Students must consider, for example, the different effects of using ordinal numbers versus percentages, means versus medians, raw numbers versus adjusted numbers, exact numbers versus approximated or rounded numbers, and so forth. In all cases, they must consider their communicative goals and their audience's interests, needs, and background and to use numbers effectively within that rhetorical context.

The proposed ways to create QW Assignments

There are many different ways to create QW assignments. In fact, the range of genres, stakes, and complexity of QW writing assignments is identical to that of other writing tasks. Here are some of the variables that instructors can consider in designing an assignment:

Sources of Data
- Provide students with the basic data
- Have students find their own data
- Have students generate their own data
- Ask students to analyze and evaluate the use of data in an article or website
Forms of Data
- Table
- Graph
- Map, chart or other image
- Prose passages using data

Length and stakes
- Low stakes assignments such as in-class freewrites, journal entries, thinking pieces, e-board postings
- Short, formal pieces that teach targeted skills such as interpreting and referencing a table, placing numbers in context, constructing a graphic, or adapting use of numbers to different audiences
- Major assignments

Genre, audience, and purpose
- Academic/scholarly paper using numbers appropriately for an expert audience
- White paper, letter to editor, op-ed piece, magazine article, or letter to a client using numbers appropriately for a lay audience
- Informative purpose using quantitative data to enlarge audience's understanding of a topic
- Analytical or interpretive purpose using quantitative data to clarify audience's view of a topic
- Persuasive purpose using quantitative data to change audience's view of a topic

Difficulty of the data or the complexity of the analysis
- Tasks suitable for general education courses using high-school level math--ratios, percentages, interpretation of graphs and tables, differences between mean and median or raw versus adjusted numbers, and so forth

In all cases, the goal of the QW assignment is to help students make meaning with quantitative data in a context of purposeful communication.