# Annexe A: New/Revised Course Content in OBTL+ Format

## Course Overview

| | |
|---|---|
| Expected Implementation in Academic Year | AY2026-2027 |
| Semester/Trimester/Others (specify approx. Start/End date) | Semester 1 |
| Course Author<br>* Faculty proposing/revising the course | Yeo Kwee Poo |
| Course Author Email | kweepoo@ntu.edu.sg |
| Course Title | Sampling and Survey |
| Course Code | MH4511 |
| Academic Units | 4 |
| Contact Hours | 52 |
| Research Experience Components | Not Applicable |

## Course Requisites (if applicable)

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|---|---|
| Pre-requisites | MH2500 Probability & Introduction to Statistics and MH2510 Statistics I.<br><br>OR<br><br>MH2500 Probability & Introduction to Statistics and MH3500 Statistics. |
| Co-requisites | |
| Pre-requisite to | |
| Mutually exclusive to | HE2020 Survey Methods and Sampling Technique. |
| Replacement course to | |
| Remarks (if any) | |

## Course Aims

Surveys and samples is part of our daily life. By understanding the basic characteristics of various sampling designs, you will be able to appreciate information reported in the medias. This course gives an introduction to the statistical aspects of taking and analysing a sample. You will learn to determine the appropriate design in various situations, use the correct method for analysis and interpret the results. This course is essential for working Statisticians.

## Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

| | |
|---|---|
| ILO 1 | Recognise and describe various sampling designs discussed throughout the course. |
| ILO 2 | Compute the estimates for population mean, proportion and total under each of the sampling schemes. |
| ILO 3 | Construct confidence intervals for the population parameters. |
| ILO 4 | Apply ratio and regression estimations to improve the accuracy of estimates. |
| ILO 5 | Determine the sample size required and its allocation under given conditions. |
| ILO 6 | Explain the importance of nonresponse and apply techniques to reduce nonresponse rate. |

## Course Content

Probability Sampling

- Types of Probability Samples
- Simple Random Sampling
- Estimation of Population Mean, Proportion and Total
- Sample Size Estimation
- Systematic Sampling

Stratified Sampling

- Theory of Stratified Sampling
- Sampling Weights
- Estimation of Population Mean, Proportion and Total
- Allocating Observations to Strata
- Sample Size Estimation
- Defining Strata
- Post-stratification

Ratio and Regression Estimations

- Ratio Estimation
- Regression Estimation
- Selecting the Sample Size
- Relative Efficiency of Estimators

Cluster Sampling

- One-Stage and Two-Stage Cluster Samplings
- Estimation of Population Mean, Proportion and Total
- Selecting the Sample Size
- Cluster Sampling with Probability Proportional to Size

Sampling with Unequal Probabilities

- One-Stage Sampling with Replacement
- Two-Stage Sampling with Replacement
- Unequal-Probability Sampling without Replacement

Nonresponse

- Effects of Ignoring Nonresponse

- Call backs and Two-Phase Sampling
- Weighting Methods for Nonresponse
- Imputation

## Reading and References (if applicable)

1 Sampling: Design and Analysis. Lohr, 2nd Ed, 2010, Brooks/Cole (978-0495105275)

2 Elementary Survey Sampling. Scheaffer, et al., 7th Ed, 2012, Brooks/Cole (978-0840053619)

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they are available.

## Planned Schedule

| Week or Session | Topics or Themes | ILO | Readings | Delivery Mode | Activities |
|---|---|---|---|---|---|
| 1 | Introduction and review of basic Statistics | 1 | Lecture notes | In-person | |
| 2 | Probability sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 3 | Probability sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 4 | Probability sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 5 | Stratified sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 6 | Stratified sampling, Ratio and regression estimations | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 7 | Ratio and regression estimations | 2,3,4, 5 | Lecture notes / Tutorial / Assignment | In-person | Midterm Test |
| 8 | Ratio and regression estimations | 2,3,4, 5 | Lecture notes / Tutorial / Assignment | In-person | |
| 9 | Cluster sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 10 | Cluster sampling | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 11 | Sampling with unequal probability | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 12 | Sampling with unequal probability | 2,3,5 | Lecture notes / Tutorial / Assignment | In-person | |
| 13 | Nonresponse | 6 | Lecture notes | In-person | |

## Learning and Teaching Approach

| Approach | How does this approach support you in achieving the learning outcomes? |
|---|---|
| Lecture | Help you understand the motivation and definitions of the concepts and notions, approaches to solving problems in pursuant to learning outcomes |
| Assignment | Develop writing and presentation skills, strengthen the understanding of the concepts and notions, and apply the techniques in problem solving |
| Tutorial | Develop problem solving skills, reinforce the understanding of the concepts and notions |

## Assessment Structure

Assessment Components (includes both continuous and summative assessment)

| No. | Component | ILO | Related PLO or Accreditation | Weightage | Description of Assessment Component | Team/Individual | Rubrics | Level of Understanding |
|---|---|---|---|---|---|---|---|---|
| 1 | Summative Assessment (EXAM): Final exam(Final Examination) | 1-6 | | 60 | Two hours in class Final Examination. | Individual | Analytic | Multistructural |
| 2 | Continuous Assessment (CA): Test/Quiz(Mid-Term Test) | 2-5 | | 20 | One and a half hours in class test. | Individual | Analytic | Multistructural |
| 3 | Continuous Assessment (CA): Assignment(Weekly/Bi-weekly Assignments) | 1-5 | | 20 | Weekly/Bi-weekly Assignments. | Individual | Analytic | Multistructural |

Description of Assessment Components (if applicable)

Formative Feedback

Component 2: Feedback on common mistakes and the level of difficulty of the problems will be given to you.

Component 3: You will receive individual written and/or verbal feedback about your assignments, as the lecturer will return each assignment individually.

## NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

| Attributes/Competency | Level |
|---|---|
| Decision Making | Advanced |
| Digital Fluency | Intermediate |
| Learning Agility | Advanced |
| Problem Solving | Advanced |
| Sense Making | Advanced |

# Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assignments and take the midterm test. You are expected to take responsibility to follow up with course notes, assignments and course related announcements if they are absent.

Policy (Absenteeism)

Absence from test and examination without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

Absence Due to Medical or Other Reasons:
If you are sick and not able to attend the midterm, you have to submit the original Medical Certificate (or another relevant document) to the administration to obtain official leave. In this case, the missed assessment component will not be counted towards the final grade.

The total course marks would be rescaled to a base of 100%, provided they sat for the examination of the course. The original contribution of the CAs and the final examination towards the total course mark will remain unchanged.

There is no make-up midterm.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

**Appendix 1: Assessment Criteria for Assignments, Tests and Final Exams**

The assessments are meant to ascertain your ability to:

1. Recognise and describe various sampling designs discussed throughout the course.
2. Compute the estimates for population mean, proportion and total under each of the sampling schemes.
3. Construct confidence intervals for the population parameters.
4. Apply ratio and regression estimations to improve the accuracy of estimates.
5. Determine the sample size required and its allocation under given conditions.
6. Explain the importance of nonresponse and apply techniques to reduce nonresponse rate.

| **Criteria** | **Standards** | | |
|---|---|---|---|
| | **Fail standard** | **Pass standard** | **High standard** |
| Methods of approach (LO 1, 4, 5, 6) | • Using methods that are irrelevant or do not apply to the given problem.<br>• Invoking theorems whose conditions are not satisfied. | • Using relevant methods that help solve the problem.<br>• Invoking theorems whose conditions are satisfied. | Finding methods and utilizing theorems that are both relevant and effective |
| Validity of reasoning (LO 2 to 6) | Reasoning is logically invalid. | Reasoning is logically valid. | Reasoning is logically valid and effective. |
| Clarity of argument (LO 2 to 6) | Reasoning is poorly explained or not explained at all. | Reasoning is clear but may contain some gaps. | Reasoning is clear, precise with no or insignificant gaps. |