NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

COURSE CONTENT

Academic Year	2023/2024 **Semester** 1
Course Coordinator	Dr. Yong Keen Mun Kelvin
Course Code	CH3109
Course Title	Decision Tools for Engineering Business
Pre-requisites	NIL
No of AUs	3
Contact Hours	34 hours of lectures, 5 hours of tutorials.
Proposal Date	5 May 2023

Course Aims

At the end of the course, you will be able to understand basic engineering business structure and economics, and hence identify and apply the important and common decision tools for engineering business.

Intended Learning Outcomes (ILO)

Students will be able to:
1. Explain the basic business structure, challenges, engineering economics and the importance of the common decision tools used.
2. List, describe and explain the common decision tools used for engineering business.
3. Identify and apply the decision tools for related problems.

Course Content

Key topics taught
1) Finance math basics
2) Engineering Economics
3) Project management
4) Data Exploration and data mining
5) Optimization methods for decision making

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination (2hrs; Closed Book)	1, 2, 3	EAB SLO* a, b, d, e, f, h, k, l	60%	Individual	see Appendix 1
2. Continuous Assessment 1 (CA1): Quiz	1, 2, 3	EAB SLO* a, b, d, e, f, h, k, l	20%	Individual	see Appendix 1
3. CA2: Continuous Assessment	1, 2, 3	EAB SLO* a, b, d, e, f, h, k, l	20%	Individual	see Appendix 1

2 (CA2): Quiz						
Total		100%				

Mapping of Course ILOs to EAB Graduate Attributes

Course Intended Learning Outcomes	Cat	EAB's 12 Graduate Attributes*											
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	Core	●	●		◖	●	š		š			◖	š
Explain the basic business structure, challenges, engineering economics and the importance of the common decision tools used.		a, b, d, h, k, l											
List, describe and explain the common decision tools used for engineering business.		a, b, e, k											
Identify and apply the decision tools for related problems.		d, f, e, k											

Legend:
●   Fully consistent (contributes to more than 75% of Intended Learning Outcomes)
◖   Partially consistent (contributes to about 50% of Intended Learning Outcomes)
š   Weakly consistent (contributes to about 25% of Intended Learning Outcomes)
Blank   Not related to Student Learning Outcomes

Formative feedback

After each CA, the problems will be discussed and solutions presented. Common mistakes and misunderstanding in concepts will also be addressed.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Lecture	Lectures are mainly focusing on the principles, concepts and application of decision tools in engineering business.
Tutorial	Tutorial problems are direct applications of the principles and concepts introduced in lectures. The tutorial questions are designed for students to identify, apply and solve the engineering business problems. The questions are also designed to encourage further discussions in class for better learning experience.

Reading and References

1) Financial Accounting: Tools for Business Decision Making, 7th Edition, by Paul D. Kimmel, Jerry J. Weygandt, Donald E. Kieso, 2013, Wiley
2) Fundamentals of Engineering Economics, 1st Edition, by Kal Renganathan Sharma, 2011, Cognella
3) Project Management for Business, Engineering, and Technology, 3rd Edition, by Nicholas, J.M. and Steyn, H., 2008, Elsevier.
4) Introduction to Data Mining and its Applications, 1st Edition, by S. Sumathi, S.N. Sivanandam, 2006, Springer
5) Introduction to Optimization, 1st Edition, by Pablo Pedregal, 2004, Springer

Course Policies and Student Responsibilities

Students are responsible for meeting all course requirements, observing all deadlines, examination times, and other course procedures.

Students are responsible for being on time for all lectures and tutorials. Sufficient efforts should be put into solving or attempting the tutorial problems prior to attending the respective tutorial classes.

Student who has been caught cheating will be given an "F" for the component or the course and may be expelled from the University.

Students are responsible for seeking academic help in a timely fashion.

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, and 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. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Yong Keen Mun Kelvin	N1.2-B2-26B	69081989	kmyong@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Finance statements and business decisions (Financial reporting and decisions, Account equation, Accounting practices and regulation)	1,2	
2	Finance statements and business decisions (Journals and ledgers, Revenue and matching principles, Performance metrics/indexes)	1,2	
3	Engineering Economics (Introduction, Time value of money, Rate of return analysis)	1,2	
4	Engineering Economics (Inflation, Deflation, Decisions on replacement, Benefit-cost analysis)	1,2	
5	Project Management	1,2	

	(Introduction, Lifecycle, Stakeholder management, Selection)		
6	Project Management (Procurement management, Planning, Monitoring and control, Audit, Termination)	1,2	
7	Data Exploration (DE) (Definition, Importance of DE, Visualization)	1,2	
8	Data Mining (DM) (Definition, DM Tasks, Challenges of DM)	1,2	
9	Optimization methods (Decision making problem, Optimization models, Scoring method)	1,2,3	
10	Linear programming (Transformation, Simplex method, Graphical method)	1,2,3	
11	Dynamic programming (State space, Recursive equations, Equipment replacement problem)	1,2,3	
12	Dynamic programming (Knapsack problem, Shortest path/minimum cost path problem)	1,2,3	
13	Application and Case Studies	3	

Appendix 1: EVALUATION RUBRIC: CH2109 Decision tools for Engineering Business
ASSESSMENT FORM (Course Coordinator: Yong Keen Mun Kelvin)

Criteria	Unsatisfactory: 1	Borderline: 2	Satisfactory: 3	Very good: 4	Exemplary: 5
Create and interpret financial statements, and make use of indexes based on financial statements for business decision	Unable to interpret business transactions information provided, and not able to create the relevant financial statements	Able to interpret business transactions information provided, but do not know how to create the relevant financial statements based on this information	Able to interpret business transactions information provided, and able to create the relevant financial statements based on this information	Good understanding of the business transactions information provided, and able to create the relevant financial statements based on this information. In addition, able to make use of 1 index to make sound business decision based on the statements.	Excellent understanding of the business transactions information provided, and able to create the relevant financial statements based on this information. In addition, able to make use of multiple indexes to make sound business decision based on the statements.
Understand and application of project management techniques in engineering economics environment	Unable to understand engineering economics and project management techniques	Able to understand project management techniques, but fail to apply them in engineering economics environment	Able to understand project management techniques, and apply them in engineering economics environment	Good understanding project management techniques, and apply them in engineering economics environment in a more efficient manner such as using multiple techniques concurrently	Excellent understanding project management techniques, and apply them in engineering economics environment in a more efficient and productive manner such as using multiple techniques concurrently and customizing new techniques whenever required
Understand, interpret and apply data exploration and data mining algorithms	Unable to understand, interpret and apply data exploration and data mining algorithms	Able to understand differences between data exploration and data mining, but not able to fully interpret and apply the algorithms	Able to understand differences between data exploration and data mining, able to fully interpret the technique, but not able to apply the algorithms	Good understanding of the differences between data exploration and data mining, able to fully interpret and apply the algorithms	Excellent understanding of the differences between data exploration and data mining, able to fully interpret and apply the algorithms. In addition, able to customize the algorithms for relevant problems
Interpret decision making problems and solve using optimization methods	Unable to understand decision making problems	Able to understand decision making problems, but failed to solve them using optimization methods	Able to understand decision making problems, and able to solve them using simple optimization methods	Good understanding of decision making problems, and able to solve them using more advance optimization methods such as linear programming and dynamic programming	Excellent understanding of decision making problems, and able to solve them using more advance optimization methods such as linear and dynamic programming. Able to compare the difference between linear and dynamic programming for the same problem

Appendix 2: The EAB (Engineering Accreditation Board) Accreditation SLOs (Student Learning Outcomes)

a) **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems

b) **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

d) **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

f) **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.

h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change