Subject Description Form

Subject Code	AMA505
Subject Title	Optimization Methods
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To enable students to use more advanced mathematical and computational techniques applicable in solving real engineering and management problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Master optimality conditions for nonlinear programs and duality theory for semidefinite programs. (b) Apply linear and semidefinite programming in solving practical problems. (c) Solve constrained and unconstrained optimization problems.
Subject Synopsis/ Indicative Syllabus	Linear Conic Programming Convex sets, convex functions, linear and semidefinite programming (SDP) duality, SDP representable functions, Schur complements, applications of SDP problems in signal processing, portfolio optimization and other technological problems, solvers for SDP. Nonlinear Programming Methods Unconstrained optimization: Line-search schemes, steepest descent method, Newton's method, conjugate gradient method and quasi-Newton methods. Constrained optimization: Kuhn-Tucker condition for optimality, application to solution of simple nonlinear problems. Penalty and barrier functions.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of mathematical techniques and how the techniques can be applied to solving problems. Students are encouraged to adopt a deep study approach by employing high level cognitive strategies, such as critical and evaluative thinking, relating, integrating and applying theories to practice.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Assignments	10%	✓	✓	✓
2. Mid-term test	30%	✓	✓	✓
3. Examination	60%	✓	✓	✓
Total	100 %			

Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.

Student Study Effort Required

Class contact:	
▪ Lecture	26 Hrs.
▪ Tutorial	13 Hrs.
Other student study effort:	
▪ Assignment	20 Hrs.
▪ Case study/Mini-project	38 Hrs.
▪ Self-study	40 Hrs.
Total student study effort	137 Hrs.

Reading List and References

Beck, A.	Introduction to Nonlinear Optimization: Theory, Algorithms, and Applications with MATLAB	SIAM 2014
Bertsekas, D. P.	Nonlinear Programming, 3rd Edition	Athena Scientific, 2016
Nocedal, J. and Wright, S.J.	Numerical Optimization, 2nd Edition	Springer, 2006
Boyd, S. and Vandenberghe, L.	Convex Optimization	Cambridge University Press, 2004
Rockafellar, R.T.	Convex Analysis	Princeton University Press, 1970