Subject Description Form

Subject Code	LSGI533
Subject Title	Satellite Positioning & Navigation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide advanced study in the modern technology used for navigation, with the emphasis on the Global Navigation Satellite Systems. The subject will introduce the fundamental concepts of navigation; discuss the development of satellite navigation systems; illustrate the principle of satellite positioning and their applications; identify the principles of other major navigation systems and integrate various sensors for navigation applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. master the fundamental concepts of satellite positioning and navigation, and be familiar with recent developments on various navigation systems (L5); b. analyze the performance of various navigation systems and develop new navigation systems for various applications (L5).
Subject Synopsis/ Indicative Syllabus	• **Global Satellite Navigation Systems:** The development of satellite navigation systems; Transit Doppler, GLONASS, Beidou, Galileo, and GPS and GPS modernization; navigation satellite signal structure and its positioning concepts; GNSS observables; Positioning with pseudorange; Positioning with carrier phase; GNSS for surveying applications; Other applications using GNSS; Limitations of GNSS. • **Other Navigation Systems and Integration:** Dead Reckoning and error sources; principle of inertial navigation system (INS) and error sources; INS positioning algorithms; Integration of different sensors; communication systems; integrated navigation systems for land, marine and civil aviation.
Teaching/Learning Methodology	Lectures are used to introduce key components. Seminars and guided study are to stimulate group discussions on selected topics. Assignments and self-study are designed to reinforce the subject material.

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.
	Continuous assessment	100%	✓	✓
	Total	100%		

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
	The outcome is achieved through group discussions and assignments and the outcome b is assessed through a project to let student to design a new navigation system for specified applications and to analyze the performance of the proposed navigation systems.
	Generative AI can only serve as a tool for assisting initial idea development and proofreading for project presentation and report, and any involvement of generative AI tools must be clearly acknowledged and referenced. Students are required to make close link between the subject contents and the proposed case-specific scenario to encourage critical thinking.

Student Study Effort Expected	Class contact:	
	▪ Lecture/tutorial	39 Hrs.
	Other student study effort:	
	▪ Project	35 Hrs.
	▪ Preparation to lectures	35 Hrs.
	Total student study effort:	109 Hrs.

Reading List and References	Journals
	Conference Proceedings IEEE PLAN Proceedings ION GPS Proceedings Journal of Engineering Surveying Journal of Geodesy Journal of Navigation GPS solution GPS world Books
	B. Hoffman-Wellenhof, H. Lichtenegger & J. Collins, *GPS Theory and Practice* (1993) Springer-Verlag. Biezad, D.J. (1999) *Integrated Navigation and Guidance Systems*, AIAA Education Series. David Wells, et al. (1988) *Guide to GPS Positioning*, Canadian GPS Associates. Drane, C. and Chris Rizos (1998) *Positioning Systems in Intelligent Transportation Systems*, ARTECH HOUSE. Elliott, S.D. and D.J. Dailey (1995) *Wireless Communications for Intelligent Transportation Systems*, ARTECH HOUSE. Gunter Seeber (1993) *Satellite Geodesy, Foundations Methods and Applications*, Degruyter Kayton M. and Fried W.R. (1997) *Avionics Navigation Systems*, John Wiley & sons. Hofmann-Wellenhof (2008) *GNSS — Global Navigation Satellite Systems: GPS, GLONASS, Galileo & More, Springer* *The satellite Surveying*, John Wiley & sons. Thomas A. Stanell (1978) *The TRANSIT Navigation Satellite System*. Magnavox. Zhao, Y (1997) *Vehicle Location and Navigation Systems*, ARTECH HOUSE Xu G. and Xu Y., (2020) *GPS Theory, Algorithms and Applications*, Springer

| | Nature Switzerland AG. |
| | Chen Ruizhi, (2012) *Ubiquitous Positioning and Mobile Location-Based Services in Smart Phones*, IGI Global |