1.	Name of Course/Module	Digital Watermarking
2.	Course Code	TDW3431
3.	Status of Subject	Major for B.IT Security Technology
4.	MQF Level/Stage	Bachelor Degree – MQF Level 6
5.	Version (state the date of the last Senate approval)	June 2012
6.	Requirement for Registration	TEM1116 Probability and Statistics, AND TIT3441 Information Theory, AND TCD2211 Cryptography and Data Security
7.	Name(s) of academic/teaching staff	Low Cheng Yaw Tee Connie
8.	Semester and Year offered	Trimester 1 (Delta Level)

9. Objective of the course/module in the programme :

The objective of this subject is to apply digital watermarking as an authentication tool for distribution of content over the Internet. This is especially due to the proliferation of high-capacity, digital recording devices which have fuelled increased concerns over copyright protection of content.

10. Learning Outcomes :

At the completion of the subject, students should be able to:

LO1: Distinguish digital watermarking from other related fields. (Cognitive, Level 4)

LO2: Explain different types of watermarking applications and watermarking frameworks. (Cognitive, Level 2)

LO3: Describe digital watermarking systems in terms of imperceptibility, robustness, and watermark. (Cognitive, Level 6)

LO4: Design digital watermarking systems according to application domains. (Cognitive, Level 5)

11. Synopsis:

Watermarks are a valuable mechanism for protecting audio, video, and data and they are also becoming an important tool in facilitating e-commerce. Any company that is serious about safely protecting and distributing their content and products will need to know about digital watermarks.

‘Watermarks’ adalah mekanisme penting dalam melindungi audio, video dan data dan juga peralatan penting dalam bidang e-commerce. Mana-mana syarikat yang serius dalam melindungi keselamatan dan pengagihan kandungan dan produk mereka perlu mengetahui mengenai ‘digital watermarks’.

12. Mapping of Subject to Programme Outcomes :

Programme Outcomes	**% of Contribution**
PO1: Apply soft skills in work and career related activities	33.33

	PO7: Demonstrate knowledge and understanding of essential facts, concepts, principles, and theories relating to security technology	33.33
	PO8: Apply principles and knowledge of security technology in relevant areas	33.33

13. Assessment Methods and Types :

Method and Type	Description/Details	Percentage
Test	Theoretical Structured Questions	20%
Quiz	Short Theoretical Question	5%
Assignment	Research Papers, Report	15%
Final Exam	Theoretical Structured Questions	60%

14. Details of Subject

Topics	Mode of Delivery	
	Lecture	Tutorial
1. Introduction ▪ Information Hiding, Stenography, and Watermarking ▪ History of Watermarking ▪ Importance of Digital Watermarking	3	1
2. Applications and Properties ▪ Embedding Effectiveness ▪ Fidelity ▪ Data Payload ▪ Blind or Informed Detection ▪ False Positive Rate ▪ Robustness ▪ Security ▪ Cipher and Watermark Keys ▪ Modification and Multiple Watermarks ▪ Cost ▪ Evaluating Watermarking Systems	4	1
3. Models of Watermarking ▪ Watermarking as Communication with Side Information at the Transmitter ▪ Watermarking as Multiplexed Communications ▪ Geometric Models of Watermarking ▪ Distribution and Regions in Media Space ▪ Marking Spaces ▪ Correlation-Based Watermarking Systems ▪ Linear Correlation ▪ Normalized Correlation ▪ Correlation Coefficient	4	2
4. Basic Message Coding ▪ Direct Message Coding ▪ Multi-Symbol Message Coding ▪ The Problem with Simple Multi- Symbol Messages ▪ Error Correction Coding ▪ The Idea of Error-Correction Codes ▪ Trellis Codes and Viterbi Decoding ▪ Detecting Multi-Symbol Watermarks	4	2

	5. Watermarking with Side Information ▪ Optimization with Respect to a Detection Statistic ▪ Optimization with Respect to an Estimate of Robustness ▪ Informed Encoding ▪ Writing on Dirty Paper ▪ A Dirty-Paper Code for a Simple Channel	3	2
	6. Robust Watermarking ▪ Approaches ▪ Redundant Embedding ▪ Spread Spectrum Coding ▪ Embedding in Perceptually Significant Coefficients ▪ Embedding in Coefficients of Known Robustness ▪ Inverting Distortions in the Detector ▪ Pre-inverting Distortions in the Embedder ▪ Robustness to Valumetric Distortions	4	2
	7. Watermark Security ▪ Security Requirements ▪ Restricting Watermark Operations ▪ Public and Private Watermarking Applications ▪ Categories of Attack ▪ Assumptions About the Adversary ▪ Watermark Security and Cryptography ▪ Cryptographic Tools ▪ The Analogy Between Watermarking and Cryptography ▪ Preventing Unauthorized Detection ▪ Preventing Unauthorized Embedding ▪ Preventing Unauthorized Removal	3	2
	8. Content Authentication ▪ Exact Authentication ▪ Fragile Watermarks ▪ Embedded Signatures ▪ Erasable Watermarks ▪ Selective Authentication ▪ Legitimate and Illegitimate Distortions ▪ Semi-Fragile Watermarks ▪ Embedded, Semi-Fragile Signatures ▪ Tell-Tale Watermarks	3	2
	Total	28	14

15.	Tutorials		
	• Based on Lecture Materials (refer to Section 14)		
16.	Total Student Learning Time (SLT)	Face to Face (Hour)	Total Guided and Independent Learning
	Lecture	28	28
	Tutorials	14	14
	Laboratory/Practical	-	-
	Presentation	-	-
	Assignment	-	10
	Mid Term Test	2	10
	Final Exam	2	20
	Quiz	5 times	5
	Sub Total	46	87

	Total SLT	133/40 = 3.3 => 3	
17.	Credit Value		3
18.	Reading Materials :		
	Textbook		Reference Materials
	1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich and Ton Kalker, "Digital Watermarking and Steganography", The Morgan Kaufmann Series in Multimedia Information and Systems, 2nd Ed., 2008.		1. Disappearing Cryptography, Second Edition - Information Hiding: Steganography and Watermarking by Peter Wayner. 2. Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition by Bruce Schneier. 3. Computer Forensics: Incident Response Essentials by Warren G. Kruse II, Jay G. Heiser.
19.	Appendix (to be compiled when submitting the complete syllabus for the programme) : 1. Mission and Vision of the University and Faculty 2. Mapping of Programme Objectives to Vision and Mission of Faculty and University 3. Mapping of Programme Outcome to Programme Objectives 4. Programme Objective and Outcomes (Measurement and Descriptions)		