1.	Name of Course/Module	Computational Intelligence I
2.	Course Code	TCI2261
3.	Status of Subject	Major for B.IT Artificial Intelligence
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	TCP1241 Computer Programming II
7.	Name(s) of academic/teaching staff	Cheah Wooi Ping Tan Shing Chiang Lim Kian Ming
8.	Semester and Year offered	Trimester 1 (Gamma Level)
9.	Objective of the course/module in the programme :	
	This subject elaborates on computational intelligence that brings together fuzzy reasoning methods and artificial neural network technology into a common framework. The subject trains students to understand and apply the concepts of fuzzy logic and artificial neural networks and use them in the areas of uncertain reasoning, pattern recognition and fuzzy control. By using software tools, such as MATLAB, students can implement the techniques of fuzzy logic and artificial neural networks and thus, gain hands on experience through the development of the models and algorithms.	
10.	Learning Outcomes :	
	At the completion of the subject, students should be able to: LO1: Describe fuzzy logic and artificial neural networks (Cognitive, Level 1) LO2: Identify the areas where the techniques of fuzzy logic and artificial neural networks can be applied. (Cognitive, Level 1) LO3: Apply the techniques of fuzzy logic and artificial neural networks in small cases. (Cognitive, Level 3) LO4: Develop efficient algorithms of fuzzy logic and artificial neural networks in various application domains. (Cognitive, Level 5)	
11.	Synopsis:	
	The subject introduces two main components of computing methods: artificial neural networks and fuzzy systems, that form a domain called as Computational Intelligence. Computational intelligence also covers numerical interpretation of biological intelligence and it offers a facility of automatic generation of knowledge in computational systems. In this subject, the state-of-the-art methods of fuzzy reasoning and artificial neural networks will be presented.	
	Subjek ini memperkenalkan dua komponen utama teknik-teknik komputasi: rangkaian neural buatan dan sistem kabur, dalam lapangan Kepintaran Komputasi. Kepintaran Komputasi adalah berasaskan interpretasi secara matematik daripada kepintaran biologi. Ia menawarkan kemudahan untuk mencetus penghasilan pengetahuan secara automatic dalam sistem-sistem perhitungan. Dalam subjek ini, teknik-teknik berkenaan sistem kabur dan rangkain neural buatan diperkenalkan.	
12.	Mapping of Subject to Programme Outcomes :	

	Programme Outcomes	% of Contribution
	PO1: Apply soft skills in work and career related activities	16.67
	PO7: Demonstrate knowledge and understanding of essential facts, concepts, principles, and theories relating to artificial intelligence	33.33
	PO8: Apply principles and knowledge of artificial intelligence in relevant areas	33.33
	PO9: Demonstrate the ability in analysing, modelling, designing, developing and evaluating computing solutions	16.67

13. Assessment Methods and Types :

Method and Type	Description/Details	Percentage
Final Exam	Written Exam	50%
Test	Written Exam	20%
Quiz	Written Exam	10%
Assignment	Report & Presentation	20%

14. Details of Subject

Topics	Mode of Delivery		
	Lecture	Tutorial	Lab
1. Introduction to Computational Intelligence Computational Intelligence components and characteristics, Computational Intelligence vs. Conventional Artificial Intelligence	1	0	0
2. Artificial Neural Networks: Introduction Biological neurons and artificial neurons, history of neural networks, neuron models, network architectures, transfer functions, single and multilayer neural networks.	1	1	0
3. Artificial Neural Networks: Single and Multilayer Perceptrons McCulloch Pitts (MCP) neuron model, perceptron, Adaline, Madaline, multilayer perceptrons and back-propagation, linear separability.	6	3	2
4. Artificial Neural Networks: Other Artificial Neural Networks Bi-directional associative memory, Hopfield network, counter propagation network, radial basis function networks, Kohonen's self-organising networks, adaptive resonance theory based networks.	4	2	2
5. Artificial Neural Networks: Learning Processes Hebbian learning, competitive learning, Boltzmann learning, supervised learning, unsupervised learning, reinforcement learning.	2	1	2
6. Artificial Neural Networks: Applications Application of artificial neural networks	2	0	0
2. Fuzzy Computing: Introduction Uncertainty and imprecision, classical sets, operations on classical sets	1	1	0
3. Fuzzy Computing: Fuzzy Sets Fuzzy sets and properties, fuzzy set operations, properties of fuzzy sets	2	1	0
4. Fuzzy Computing: Fuzzy Relations Fuzzy relations, fuzzy Cartesian product and composition	2	1	0

	5. Fuzzy Computing: Fuzzy Logic Membership functions, features of the membership function, fuzzification	2	1	0
	6. Fuzzy Computing: Fuzzy Rule Based Systems Fuzzy rule based systems, decomposition of compound rules, aggregation of fuzzy rules and inference methods, defuzzification methods	2	1	4
	7. Fuzzy Computing: Applications Extension principle, control applications	1	0	0
	Total	**26**	**12**	**10**

15.	Laboratory		
	Mainly using MATLAB or other tools: 1. Design and implementation of a fuzzy system. 2. Design and implementation of a artificial neural network.		
16.	Total Student Learning Time (SLT)	Face to Face (Hour)	Total Guided and Independent Learning
	Lecture	26	26
	Tutorials	12	12
	Laboratory/Practical	10	5
	Presentation		
	Assignment	-	10
	Mid Term Test	1	5
	Final Exam	2	20
	Quizzes	2 times	2
	Sub Total	51	80
	Total SLT	131/40 = 3.275 => 3	
17.	Credit Value	3	
18.	Reading Materials :		
	Textbook	Reference Materials	

	1. Haykin, S. (2009) Neural Networks and Learning Machines (3rd Edition), Pearson, ISBN : 978-0131471399	1. Negnevitsky, M. (2004) Artificial Intelligence: A Guide to Intelligent Systems (2nd Edition), Addison Wesley, ISBN : 978-0321204660 2. Yaochu, J. (2003) Advanced Fuzzy Systems Design and Applications, Physica-Verlag Heidelberg, ISBN : 978-3790815375 3. Jeff, H. (2008) Introduction to Neural Networks for C# (2nd Edition), Heaton Research, ISBN : 978-1604390094 4. Laurene V. F. (1993) Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Prentice Hall, ISBN : 978-0133341867 5. Tanaka, K. (1996) An Introduction to Fuzzy Logic for Practical Application, Springer, ISBN : 978-0387948072 6. Hagan, M. T., Demuth, H.B. (1995) Neural Networks Design, PWS Publishing, ISBN : 978-0971732100 7. George, J. K., Yuan, B. (1995) Fuzzy Sets and Fuzzy Logic: Theory and Applications, ISBN : 978-0131011717
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)	