UNIVERSITY OF MALAWI-THE POLYTECHNIC
FACULTY OF ENGINEERING
ELECTRICAL ENGINEERING DEPARTMENT

1.	**Programmes:**	**BELE, BEC**
2.	**Module Title:**	Computational Intelligence
3.	**Module Code:**	ELE-COI-5-1
4.	**Level:**	4
5.	**Credit:**	10
6.	**Presented to:**	Senate
7.	**Presented by:**	Faculty of Engineering
8.	**Lectures (Hrs/Wk):**	3
9.	**Tutorials:**	1
10.	**Prerequisites:**	ELE-PRS-3-2, ELE-SOE-4.2
11.	**Co-requisites:**	None

12. **Module Aim**

To provide students with knowledge and skills on concepts, models, algorithms and tools for development and applications of intelligent systems

13. **Intended Learning Outcomes**

On completion of this module, the student should be able to:

a. Design intelligent systems
b. Analyse intelligent systems
c. Apply Computational Intelligence techniques to classification, pattern recognition, prediction, rule extraction, and optimization problems.
d. Evaluate Computational Intelligence techniques used in Engineering applications

14. **Indicative Content**

a. **Artificial Neural Networks (ANNs):**
The Artificial Neuron; Supervised Learning Neural Networks; Unsupervised Learning Neural Networks; Radial Basis Function Networks. Applications of ANNs.

b. **Evolutionary Computing (EC):**
A brief introduction of the following EC techniques - Genetic Algorithms (GAs), Genetic Programming (GP), Evolutionary Programming (EP), Evolutionary Strategies (ESs). Applications of these algorithms EC techniques.

c. **Swarm Intelligence (SI):**
Particle Swarm Optimization (PSO); Ant Colony Optimization; Cultural Evolution. Applications of Swarm Intelligence. The integration of Swarm Intelligence and Cultural Evolution.

d. **Fuzzy Systems (FS):**

Fuzzy Systems; Fuzzy Logic; Fuzzy Interference Systems; Fuzzy Controllers; Rough Sets. Applications of Fuzzy Sets

e. **Artificial Immune Systems (AIS):**
The AIS theory; the design of robust controllers using AIS.

f. **Hybrid Systems:**
The integration of these CI paradigms in the development of hybrid systems for solving engineering problems.
Applications will include design of optimal digital circuits, mapping and routing on hardware such as FPGA, modeling nonlinear systems, design of optimal, adaptive and nonlinear controllers for systems, modeling and control of power systems, image and signal processing, biometrics applications, robotics, etc.

15. **Assessment**
Examination 70%
Course Work 30%

16. **Teaching and Learning Methods**
Lectures, tutorials and group discussions

17. **Prescribed text**
Engelbrecht, A.P. (2003), Computational Intelligence: An Introduction, New York: John Wiley.

18. **Recommended Texts**

a. Engelbrecht, A.P.(2005), Fundamentals of Computational Swarm Intelligence, Wiley
b. Haykin, S. (1999) Neural Networks- A Comprehensive Foundation 2nd Edition Macmillan College Publishing Company, New York
c. Zurada, J.(1992), Introduction to Artificial Neural Systems, St. Paul: West Publishing Company,