JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGENT

3RD YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3317

COURSE TITLE: INNOVATIONS AND DESIGNS

EXAM VENUE: CR **STREAM: BSc REN ENERGY TECH & MGT**

DATE: 15/12/2017 **EXAM SESSION: 9.00 – 11.00 AM**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION 1

a) Define innovation (2.5 Marks)
b) List the two major categories and the five types of innovations that are associated with Schumpeter's theory and define the following; Product innovation, process innovation and technological innovations (16.5 Marks)
c) State the five generation models of the innovation process and the key features (6 Marks)
d) Innovation theory suggest innovation to be a 'process; list and explain the three models of innovation (5 Marks)

QUESTION 2

Engineering is a profession whereby principles of nature are applied to build useful objects and determining the best design often uses optimization.

a) What is an optimization algorithm and the two key design objectives; (1.5 Marks)
b) Name and explain the two most distinct types of optimization algorithms that are today widely used. (3 Marks)
c) What is the purpose of optimal problem formulation in an optimization; (1.5 Marks)
d) Explain and show a sketch outline of the steps usually involved in an optimal design formulation. (5.5 Marks)
e) In optimization; explain the term design variables; and constraints (giving two types of constraints) (6 Marks)

QUESTION 3

Systems engineering is complex and has many definitions;

a) State two of the definitions (2 Marks)
b) Sketch a flow diagram of re-evaluating systems engineering concepts using systems thinking; from customer need to product and process (7 Marks)
c) Sketch a V model explaining the systems engineering approach to design of complex systems from concept of operations to acceptance test. (5.5 Marks)
d) Give three terms that define the term engineering system requirement, its stated characteristics and the characteristics of a good requirement. (5.5 Marks)

QUESTION 4

a) Define the following terms with reference to systems Engineering; Verification, Validation, Static Analysis, Dynamic Analysis, Safety, Risk and Hazard. (7 Marks)
b) Mention four Validation types and explain two testing techniques in engineering systems (6 Marks)
c) Explain the two aspects that cover the scope of safety engineering (3.5 Marks)
d) Draw a tree diagram that cover the aspects in the term dependability of safety Engineering. (3.5 Marks)

QUESTION 5

Once a good model is obtained, optimization results can often be realized quickly;

a) Explain what a model is and the two types often used in optimization models (3 Mark)
b) Solve the below linear Programme to optimality

Maximize; $X_1 + X_2$

$2X_1 + X_2 \leq 4$

$X_1 + 2X_2 \leq 3$

$X_1 \geq 0, X_2 \geq 0$, (17 Marks)