JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATION FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

3RD YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1313

COURSE TITLE: INNOVATION AND DESIGN

EXAM VENUE: MAIN CAMPUS **STREAM: BSc. REN ENGY TEC & MGT**

DATE: 8/1/2025 **EXAM SESSION:9-11.00 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 ONE

a) Define the term innovation and also define its components **(4 Marks)**
b) Mention or state the five aspects that thereof do cover or steer innovation at individual level or organizations. **(5 Marks)**
a) Disciplines of innovation is just one aspect in b); and there is its subset" Systematic knowledge acquisition Characteristic due to individuals or organization's"
   i) State five other disciplines **(5 Marks)**
   ii) State and explain the four broad categories of "Systematic knowledge acquisition Characteristic" due to individuals and or organization's" **(16 Marks)**

QUESTION TWO

An engineer is interested in the best of a design done by *optimization*. Thus, need for a *quantitative model (the* analysis models) - analysis variables (inputs) and analysis functions (outputs) -That could be in form of the below equations for a simple tubular symmetric truss.

a) Weight = $p \cdot 2 \cdot \Pi \cdot d \cdot t\sqrt{\left(\frac{B}{2}\right)^2 + H^2}$
b) stress = $\frac{P\sqrt{\left(\frac{B}{2}\right)^2 + H^2}}{2 \cdot t \cdot \pi \cdot d \cdot H}$
c) Buckling Stress = $\frac{\Pi^2 E\left(d^2 + t^2\right)}{8\left[\left(\frac{B}{2}\right)^2 + H^2\right]}$
d) Deflection = $\frac{P\left[\left(\frac{B}{2}\right)^2 + H^2\right]^{(3/2)}}{2 \cdot t \cdot \Pi \cdot d \cdot H^2 \cdot E}$

From the above;

i) Define the term optimization in regard to an engineering design **(2.5 Marks)**

Hence;

ii) Identify an analysis model **(2.5 Marks)**
iii) Identify and list the analysis variables **(2.5 Marks)**
iv) Identify and list the analysis functions **(2.5 Marks)**
v) Given the truss design example; calculate the outputs (No; 8,9,10 and 11). **(10 Marks)**

QUESTION THREE

a) Name and explain in a sequence the ten steps that are commonly executed during a design **(10 Marks)**
b) Name and define without regard to level of hierarchy of a system, its three main things; **(3 Marks).**
c) Formulation of a system (thus inputs, process, output and its environment) must have a function for the intended objective; Using an example, define and explain systems;
   i) inputs and outputs **(2 Marks)**
   ii) The inputs three groups **(3 Marks)**
   iii) and the outputs two subdivisions **(2 Marks)**

d) or instead of c) sketch the common practice and the Ideal process of design

QUESTION FOUR

i) Define an Engineering system and mention or give two examples **(2 Marks)**

ii) Differentiate between analytic and systems approaches in a design process, also distinguish their mode of thinking. **(3 Marks)**

iii) Mention the two broad classification of a design system and six other ways in which they can be reorganized or categorized. **(8 Marks)**

iv) Mention and define the three words that constitute the design system hierarchy; together with the other interchangeable synonyms. **(7 Marks)**

QUESTION FIVE

a) Define the following with reference to systems Engineering; Verification, Validation, Static Analysis, Dynamic Analysis, Safety, Risk and Hazard. **(7 Marks)**

b) State 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)**