**TECHNICAL UNIVERSITY OF MOMBASA**

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**Faculty of Engineering and Technology**
**Department of Mechanical & Automotive Engineering**
**UNIVERSITY EXAMINATION FOR:**
**BSc. Mechanical Engineering**
**EMG 2506 : REVERSE ENGINEERING**
**SPECIAL SUPPLEMENTARY EXAMINATION**
**SERIES: SEPTEMBER 2018**
**TIME: 2 HOURS**
**DATE:** Pick Date **Sep 2018**

**Instruction to Candidates:**

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

Maximum marks for each part of a question are as shown.

**Do not write on the question paper.**

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**Question ONE**

a) Give **TWO** reasons why it may become necessary to reverse engineer a product or component.

(2 marks)

b) Describe in detail why reverse engineering plays an important role in the aviation industry in particular.

(6 marks)

c) Photogrammetry is 3-D coordinate measuring technology. Using suitable diagrams explain the fundamental principle behind this process. Also describe a case in which it was successfully applied.

(10 marks)

d) Trade secrets are a form of intellectual property. Describe the rights and risks attached to this form of protection and highlight a notable case.

(4 marks)

e) Describe the following additive manufacturing techniques:

i) Laser power forming

(4 marks)

ii) Polyjet

(2 marks)

iii) Laminated object manufacturing

(2 marks)

**Question TWO**

a) Explain the five-step process of geometric modeling practiced in reverse engineering industries.

(10 marks)

b) Interferometry is an imaging technique that can be used to capture very large objects using light. Discuss in detail how the process is able to achieve this.

(10 marks)

**Question THREE**

a) Describe the following additive manufacturing processes used in rapid prototyping.

i) Selective laser sintering (SLS)

(5 marks)

ii) Fused deposition modeling (FDM)

(5 marks)

b) Discuss the following rapid prototyping methods

i) Subtractive prototyping

(5 marks)

ii) Rapid injection molding

(5 marks)

**Question FOUR**

a) Heat treatment has historically been used in order to obtain optimal mechanical properties. Discuss how the most commonly applied heat treatment processes are able to achieve this.

(10 marks)

b) Material properties are not mutually exclusive and a link may exist between them. Using suitable examples describe how mechanical, metallurgical and physical properties of materials interact with each other.

(5 marks)

c) Fatigue is a dynamic and time-dependent failure mechanism. Describe how and when it occurs and give the minimum conditions required.

(5 marks)

**Question FIVE**

a) Describe, using suitable examples, deterministic and probabilistic methods used in the performance evaluation of reverse engineered components.

(4 marks)

b) Engineered components are adversely affected by a numbers of environmental factors. Describe in detail how environmental resistance analysis of these components is carried out while highlighting a number of ASTM standards guiding the same.

(16 marks)