TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Mechanical Engineering
EMG 2506 : REVERSE ENGINEERING
END OF SEMESTER EXAMINATION
SERIES: DECEMBER2016
TIME: 2 HOURS
DATE: Pick Date**Dec2016**

Instruction to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions.
Question **ONE** is **COMPULSORY**
Attempt any other **TWO** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.
Mobile phones are not allowed in the examination room.

Question ONE (COMPULSORY: 30 Marks)
Outline and briefly describe (with examples) the important stages in the design process of a manufactured article, including the activities involved in product design and development. Elaborate specifically on the principle aspect of Intellectual Property (IP) rights and value addition within the design process.   (30 Marks)

Question TWO (20 Marks)
   a) List two considerations kept in mind while designing a frictional clutch.
                                                                                    (2 Marks)
   b) Show that the torque transmitted by a plate clutch T is given by:

$$T = \mu.W.R \qquad \text{where:} \qquad R = \frac{2}{3}\left[\frac{r_1^3 - r_2^3}{r_1^2 - r_2^2}\right]$$

Considering a uniform pressure plate clutch (10 Marks)

c) A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 120 kW at 1500 rpm. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4. Assuming a uniform pressure of 0.17 N/mm², determine the inner diameter of the inner surface.
(8 Marks)

Question THREE (20 Marks)

a) State FOUR factors that determine the coefficient of friction between the belt and the pulley (4 Marks)

b) If the slip between the driver and the belt is S_1%, and that between the belt and the follower is S_2%. Show that:

$$VelocityRatio = \frac{d_1 + t}{d_2 + t}\left(1 - \frac{s}{100}\right)$$

   Where: t is the thickness of the belt
            d_1 is the diameter of the driver
            d_2 is the diameter of the follower (6 Marks)

c) Two pulleys one 450 mm diameter and the other 200 mm diameter on parallel shafts 1.95 m apart are connected by an open belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1 KN, and the coefficient of friction between the belt and the pulley is 0.45? (10 Marks)

Question FOUR (20 Marks)

State the purpose of product analysis. Explain the phases of product analysis.
(20 Marks)

Question FIVE (20 Marks)

a) People who follow procedures and processes with a blind allegiance and without using their brain to critically think and understand what they are doing, lose the benefit of applying their own creative ability to search for a better more elegant solution. Name and briefly explain five methods which stimulate creativity?
(10 Marks)

b) Biologically inspired designs have served humanity over millions of years; explain how a young quacking duck attracts its mother and what are the main design factors in an innovation of an electronic toy device that can attract the same mother? (5 Marks)

c) The ability to compute separates the engineer from the technician. Engineering mathematics generates an insight (i.e., an intuitive understanding) into the behavior of physical things which cannot be attained in any other way and which is essential for inventive thinking i.e. the generation of new valuable ideas which will work. In the innovative design of a flying car, name and briefly explain five of the major functional considerations.　　　　　　　(5 Marks)