



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Marine Engineering
EMR 2219 : Applied Mechanics II
SPECIAL/ SUPPLEMENTARY EXAMINATION
SERIES: AUGUST 2019
TIME: 2 HOURS
DATE: Pick Date Aug 2019

Instruction to Candidates:

You should have the following for this examination

- *Student I.D. Card & Examination Pass*
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

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

Do not write on the question paper.

Question ONE

- a) Derive the expressions for circumferential and longitudinal stresses for a thin cylindrical pressure vessel.
- b) A cylindrical compressed air drum is 2 m in diameter with plates 12.5 mm thick. The efficiencies for longitudinal and circumferential joints are respectively 85 and 45%. If the tensile stress in the plating is to be limited to 100 MN/m² find the maximum safe air pressure.

(20 marks)

Question TWO

- a) Explain the assumptions made in the theory of torsion. **(6 marks)**
- b) A solid circular steel shaft 1.5 m long has its diameter turned down from 45 mm to 35 mm diameter over a length of 0.5 m. it is used to transmit 80 kW of power at 1400 rev/min. determine the maximum stress developed in the 45 mm diameter section and the total angular twist in degrees. Take $G = 80 \text{ GN/m}^2$. **(14 marks)**

Question THREE

- a) Derive the expression for the ratio of belt tensions for a flat belt partly wound round a pulley so that the angle of lap is ϑ .
- b) A ship is dragged through a lock by means of a capstan and rope. The capstan which has a diameter of 500 mm, turns at 30 rev/min. the rope makes 3 complete turns around the capstan, μ being 0.25 and at the free end of the rope a pull of 100 N is applied. Find the pull on the ship and the power required to drive the capstan.

(20 marks)

Question FOUR

A friction clutch is required to transmit 34.5 kW at 2000 rev/min. If it is to be of single plate disc type with both sides of the plate effective, the pressure being applied axially by means of springs and limited to 70 kN/m². If the outer diameter of the plate is 300 mm find the required inner diameter of the clutch ring and the total force exerted by the springs. Assume the wear to be uniform. Take $\mu = 0.3$

(20 marks)

Question FIVE

- a) Using a suitable sketch explain the following terminologies of gear drives:
- i. Pitch circle diameter
 - ii. Circular pitch
 - iii. Addendum
 - iv. Dedendum
 - v. Module
- b) A gear wheel having 20 teeth of involute form of 6.5 modules and angle of obliquity 20° drives another wheel of the same dimensions. Calculate the length of the arc of contact if the addendum is 6.5 mm.

(20 marks)