PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINERING

EXAMINATION QUESTION PAPERS

ME 312
MECHINES DESIGN

SEMESTER ONE – 2024

BY GK

The Papua New Guinea University of Technology

Mechanical Engineering Department

2024 Semester One – Final Examinations

Tuesday, May 28, 2024

ME312 – Machine Design

Time Allowed: Two Hours

INSTRUCTION FOR STUDENTS

1. You have 10 minutes to read the paper. Do not write anything during this time.
2. Total number of questions – six (6). Answer all questions.
3. Show your work clearly. For full credit show all steps including correct use of units.
4. Notes and text books are not allowed. Calculators are permitted in the examination room.
5. Write your name and student number clearly on the front of the answer booklet. Do it now.
6. Start each question on a new page and show all your work in the answer book provided.
7. Total marks: 100

Answer all the following questions — Total Marks [100 marks]

1. Write the factor of safety equation in case of brittle and ductile machine components. **(10 marks)**

2. What are the three primary types of gears, and what is their function? ***(15 marks)***

3. There are eight factors to be considered in machine design. List only four factors. **(15 marks)**

4. The maximum ultimate tensile stress for aluminium is 300 N/mm^2. If the working stress on a component is 50 N/mm^2, calculate the factor of safety applied in the design of the component. **(15 marks)**

5. A solid shaft is transmitting 1 MW at 240 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa.
   Given: $P = 1MW = 1\times10^3$ W, $N = 240$ r.p.m., $T_{max} = 1.2T_{mean}$, $\tau = 60$ MPa $= 60$ N/mm^2 **(20 marks)**

6. A line shaft rotating at 200 r.p.m. is to transmit 20 kW. The shaft may be assumed to be made of mild steel with an allowable shear stress of 42 MPa. Determine the diameter of the shaft, neglecting the bending moment on the shaft.
   Given: $N = 200$ r.p.m.; $P = 20$ kW $= 20 \times 10^3$ W; $\tau = 42$ MPa $= 42$ N/mm^2 **(25 marks)**