GEARS AND GEAR TRAINS — SOLUTION KEY

Total Points: 30 | Questions: 3 | Date: March 07, 2026

INSTRUCTOR COPY — CONTAINS ANSWERS & RUBRICS — DO NOT DISTRIBUTE TO STUDENTS

AI-generated undergraduate-level mechanical assignment. Contains 3 questions covering key concepts.

Question 1

5 points

Determine the gear ratio for the gear train depicted in the diagram below, where the driver gear has 15 teeth and the driven gear has 45 teeth. Provide your answer as a simplified fraction and a decimal.

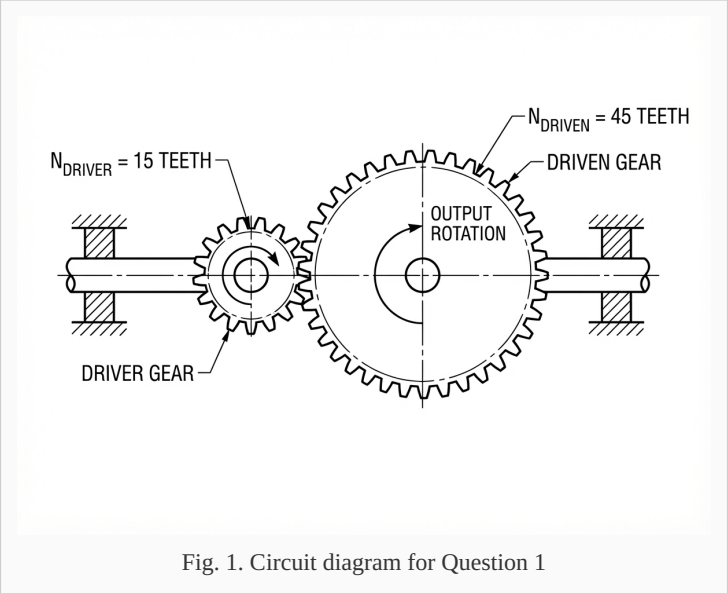

Fig. 1. Circuit diagram for Question 1

ANSWER

$\frac{1}{3}$ or 0.33

GRADING RUBRIC

- Full marks if the student provides both the simplified fraction and the decimal equivalent ($\frac{1}{3}$ or 0.33). - Partial marks if either one (fraction or decimal) is provided correctly.

Question 2

15 points

Consider the simple planetary gear train shown in the diagram below, with the following specifications: the sun gear has 20 teeth, the planet gears are 10 teeth each, and the ring gear has 60 teeth. Answer the following questions based on this setup.

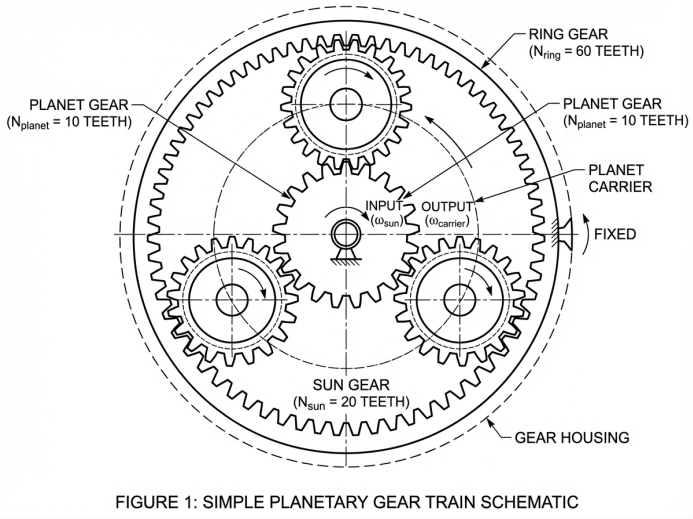

Fig. 2. Circuit diagram for Question 2

Part 2.1

5 points

What is the gear ratio between the sun gear and the ring gear?

Part 2.2

10 points

If the ring gear is held stationary, calculate the angular velocity of the planet carrier, given that the sun gear rotates at 120 RPM clockwise.

PART (A)

What is the gear ratio between the sun gear and the ring gear?

ANSWER

$3:1$

GRADING RUBRIC

- Award full marks for the correct gear ratio of $3:1$. - Provide partial marks if the student calculates a ratio that is correctly interpreted but not simplified.

PART (B)

If the ring gear is held stationary, calculate the angular velocity of the planet carrier, given that the sun gear rotates at 120 RPM clockwise.

ANSWER

$60\ \text{RPM}$ clockwise

GRADING RUBRIC

- Full marks for the correct answer of $60\ \text{RPM}$ clockwise. - Partial marks can be awarded for a correct approach if the final calculation is incorrect.

Question 3 10 points

Explain the difference between a helical gear and a spur gear in terms of their mechanical advantages and typical applications.

ANSWER

Helical gears have angled teeth, which allow for more contact and smoother transmission compared to spur gears, resulting in quieter operation and higher load capacity. They are often used in automotive transmissions. Spur gears have straight teeth, providing efficient transfer of power, but with more noise and vibration, typically used in lower-speed applications.

GRADING RUBRIC

- Award full marks for a detailed explanation covering both gears, their mechanical advantages, noise levels, and applications. - Partial marks if only one gear is covered or if the explanation lacks detail.