UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 2 Examination in Engineering: March 2026

Module Number: CE2302 **Module Name:** Mechanics of Materials (C23)

Part B - [One Hour]

Answer all questions, each question carries 12 marks

All notations have their usual meanings

Q1. A maintenance technician at a construction site is standing on a wooden plank, which is used as a temporary walkway across two supports. The plank is idealized as a simply supported beam of length L, as shown in Fig. Q1. The technician, weighing P, stands at a point D, which is at distance *a* from the left support A, and at distance *b* from the right support B.

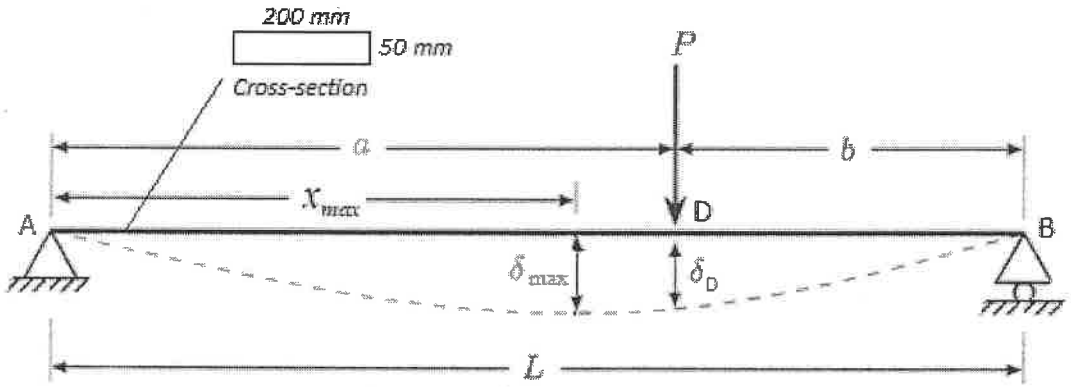

Fig. Q1

(a) Using moment area method, show that the deflection at point D is $\frac{Pa^2b^2}{3EIL}$

[4 Marks]

(b) Show that the maximum deflection, δ_{max} occurs at a distance, $x_{max} = \sqrt{\frac{a(a+2b)}{3}}$ from the support A.

[4 Marks]

(c) (i) As the technician moves from support A to support B, at what position along the span does the timber plank experience its maximum deflection?

(ii) If the timber plank has a rectangular cross-section of 200 × 50 mm and a length of 4 m, determine the maximum allowable weight of the technician (in kg) for safe travel along the plank, given that the permissible deflection must not exceed 50 mm?

[4 Marks]

Q.2 Fig. Q2 shows the stress condition at a point within a stressed body. At this point, normal stresses of 160 N/mm² (tensile) and 120 N/mm² (compressive) are applied on two mutually perpendicular planes. Given that the maximum principal stress in the material is limited to 200 N/mm² (tensile), use Mohr's Circle method to answer the following.

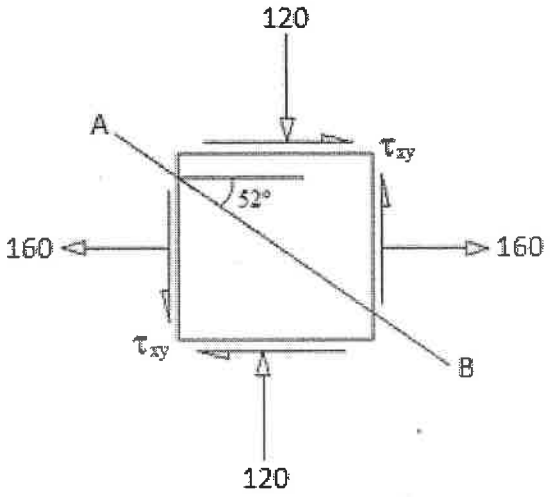

Fig. Q2

(a) Plot the Morh's circle for given stress condition and hence determine τ_{xy} [4 Marks]

(b) Determine the second principal stress and indicate its direction on the stress element [2 Marks]

(c) Determine the magnitude and direction of the normal stress and shear stress on the inclined plane AB [4 Marks]

(d) Find the maximum in-plane shear stress at the point [2 Marks]