

University of Technology - Electromechanical Engineering Department
Final Examination (2013-2014)

Class: Second

Time: 3 Hours

Subject: Theory of Machines & Strength of Materials

Examiner : Dr.Muhannad Z. and Dr.Ali K.

Note: Answer Five Questions Only.

Q1: Define the terms shear stress and shear strain, illustrating your answer by means of a simple sketch. Two circular bars, one of brass and the other of steel, are to be loaded by a shear load of 30 kN. Determine the necessary diameter of the bars (a) in single shear, (b) in double shear, if the shear stress in the two materials must not exceed 50 MN/m^2 and 100 MN/m^2 respectively.

Q2: A beam ABC is 9 m long and supported at B and C, 6 m apart as shown in Figure (1). The beam carries a triangular distribution of load over the portion BC together with an applied counterclockwise couple of moment 80 kN.m at B and a uniform distributed load (u.d.l.) of 10 kN/m over AB, as shown. Draw the S.F. and B.M. diagrams for the beam.

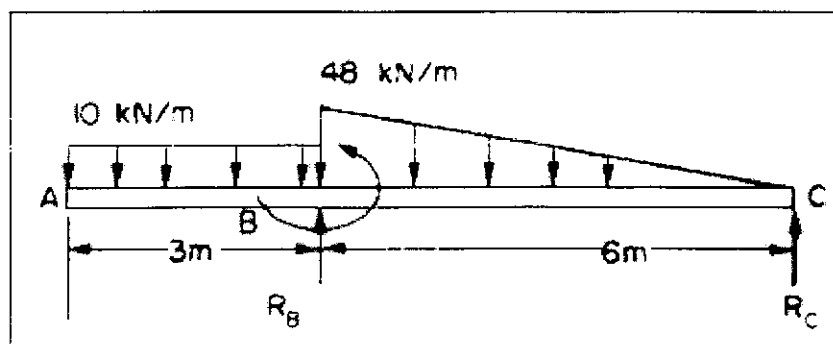


Figure (1)

Q3: An I-section girder, 200 mm wide by 300 mm deep, with flange and web of thickness 20 mm is used as a simply supported beam over a span of 7 m. The girder carries a distributed load of 5 kN/m and a concentrated load of 20 kN at mid-span. Determine: (a) the second moment of area of the cross-section of the girder, (b) the maximum stress set-up.

Q4: A belt drive consists of a V-belt working on a grooved pulley, with an angle lap of 160° . The cross-sectional area of the belt is 650 mm^2 , the groove angle is 30° and $\mu = 0.1$. The density of the belt material is 1 Mg/m^3 and its maximum safe stress is 8 MN/m^2 of cross-section. Calculate the power that can be transmitted at a belt speed of 25 m/s.

Q5: Determine the speed of rotation of the output shaft in Figure (2) and its direction of rotation when viewed from the right.

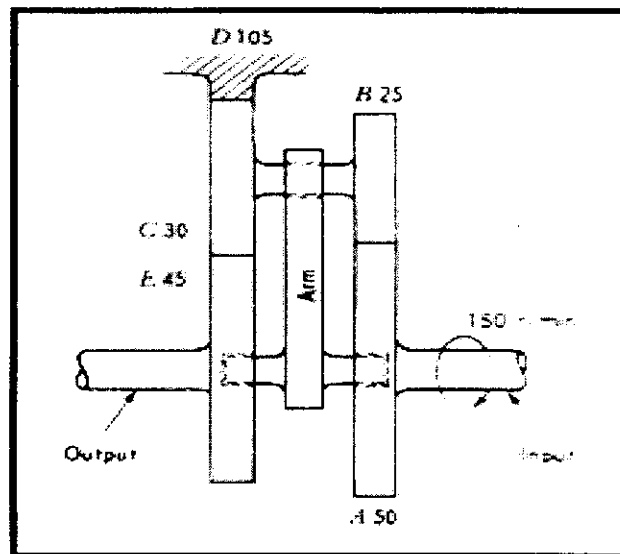


Figure (2)

Q6: Construct the velocity and acceleration polygon for Figure (3). $\omega_2 = 150$ rad/s. Determine: (a) The velocity and acceleration of slider 6 in meters per second. (b) Determine ω_3 , ω_4 and ω_5 in radians per second.

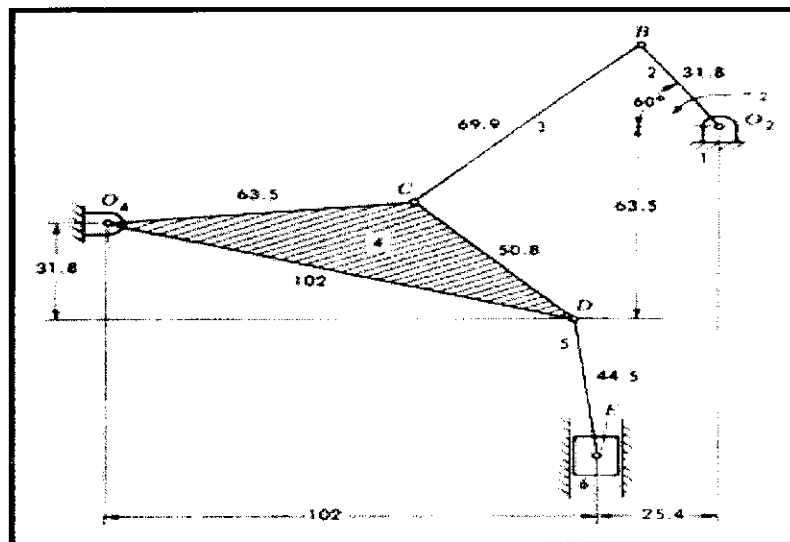


Figure (3)

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