050

THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DIPLOMA IN TECHNOLOGY – LEVEL 03
FINAL EXAMINATION 2008/2009
MEX 3271– APPLIED MECHANICS
DATE :23RD MARCH 2009
TIME :1400 HRS - 1700 HRS
DURATION :03 HOURS

Answer FIVE (05) questions at least selecting TWO from each section.

SECTION- A

Question 01:

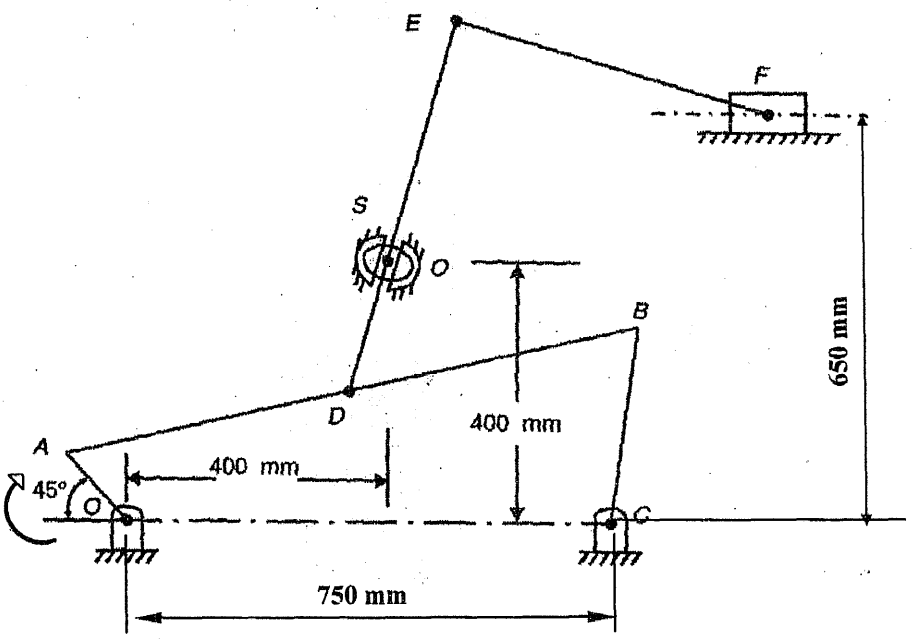


Fig.01

In the swiveling point mechanism shown in Fig.01, the dimensions of various links are: OA = 120 mm, AB = 900 mm, BC = 300mm, DE = 600 mm and EF = 500 mm. The distance OC = 750mm. The vertical distance between the point **C** and axis of slider ***F*** is 650 mm. The point ***D*** is the mid-point of link ***AB***. The crank ***OA*** rotates at 120 rpm in clockwise direction.

(i) Draw the velocity polygon for each link.
(ii) Determine the velocity of slider ***S*** in the trunnion.

Question 02:

(a) Explain the conditions 'static balance' and 'dynamic balance' with respect to rotating masses. State the requirements that satisfy the two conditions.

(b) A rotating shaft carries four masses A, B, C and D rigidly attached to it. The mass centers are at 32mm, 38mm, 41mm, and 35mm respectively from the axis of rotation. A, C and D have masses of 30kg, 20kg and 16kg. The axial distance between A and B is 400mm and that between B and C is 500mm. The eccentricities of A and C are 90^0 to one another.

For complete balance find the following:

(i) Angle between A and B
(ii) Angle between B and D
(iii) Axial distance between the planes of revolution of C and D
(iv) Mass of B

Question 03:

(a) State the advantages and disadvantages of V-belt drives over flat belt drives.

(b) Two pulleys, one 450mm diameter and the other 200mm diameter, are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley.

(c) What power can be transmitted by the belt when the larger pulley rotates at 200rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley material is 0.25?

Question 04:

a) Derive an expression for the path of contact (L) in terms of addendum circle radius (R), pitch circle radius (r) and pressure angle (φ).

b) The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20^0 involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.

SECTION- B

Question 05:

(a) Define briefly the terms 'principal stress' and 'principal plane' in two dimensional stress systems.

(b) Construct Mohr's circle for the following point stresses:

$\sigma_x = 60$ MPa, $\sigma_y = 10$ MPa and $\tau_{xy} = +20$ MPa .

Hence determine the stress components and planes on which the shear stress is a maximum.

Question 06:

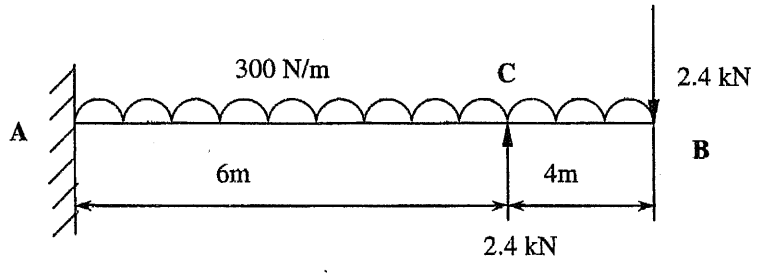


Fig 06

A beam of uniform section and length 10 m is rigidly fixed at one end as shown in Fig.06. It carries a uniformly distributed load of 300 N/m over its entire span. Vertical concentrated loads of 2.4 kN are applied at point C and B in the direction shown.

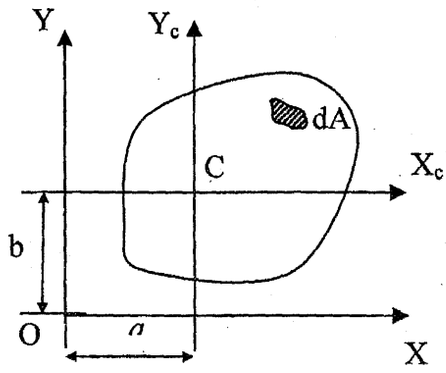
(i) Draw the free body diagram, clearly indicating the forces at the fixed end.

(ii) Draw the shear force and bending moment diagrams for the beam.

(iii) Hence determine the position and the magnitude of the maximum bending moment in the beam.

Question 07:

(i)



Show that the second moment of area (I_{OX}) of any area (A) with respect to any axes (OX) is the sum of second moment of area about a parallel centroidal axis (I_{CX_C}) and product of the same area with the square of the distance (b) between the two axes is

$$I_{OX} = I_{CX_C} + b^2 A$$

(ii)

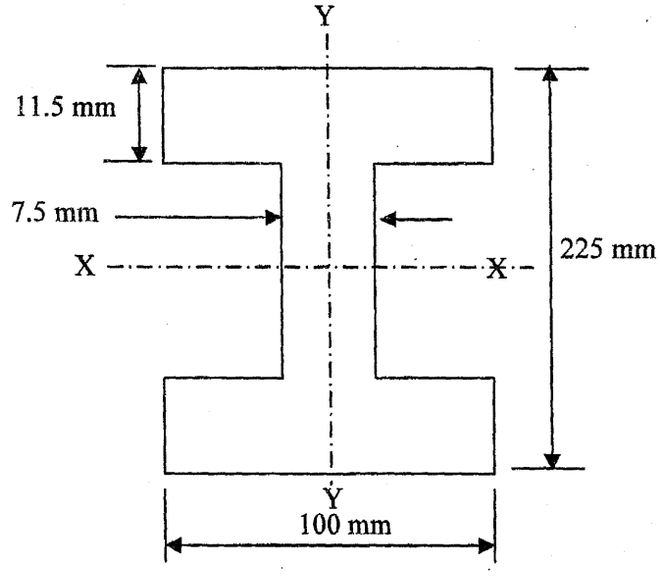


Fig.03

The beam of symmetrical I section shown in Fig.03 is simply supported over a span of 9m. If the maximum permissible stress is 75 N/mm^2 what concentrated load can be carried at a distance of 3m from one support?

Question 08:

A composite bar, made up of aluminium and steel, is firmly held between two unyielding supports as shown in Fig.Q8.

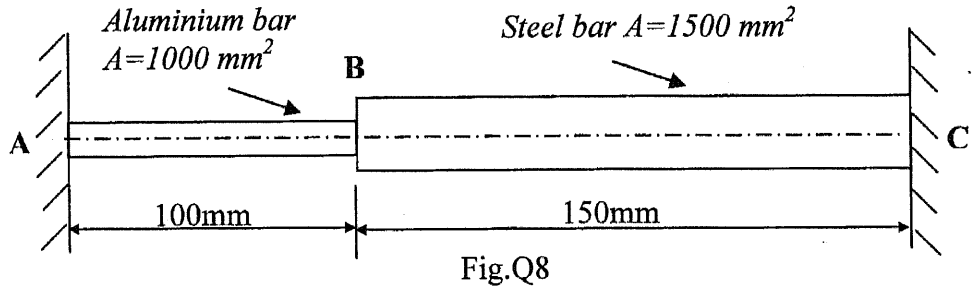


Fig.Q8

An axial load of 200 kN is applied at B at 320 K. Find the stresses in each material, when the temperature is 370 K. Take E for aluminium and steel as 70GPa and 210 GPa and coefficient of expansion for aluminium and steel as 24×10^{-6}/K and 12×10^{-6}/K respectively.

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