NATIONAL INSTITUTE OF TECHNOLOGY SILCHAR
ENGINEERING MECHANICS
First / Second Semester (All Branch)

COURSE NO. ME 101 **L T P C**
3 1 0 4

ASSIGNMENT - 1

1. A man of weight $W = 160\ N$ holds one end of a rope that passes over a pulley vertically above his head and to the other end of which is attached a weight $Q = 120\ N$. Find the force with which the man's feet press against the floor. *Ans. 40 N*

2. A boat is moved uniformly along a canal by two horses pulling with forces $P = 200\ N$ and $Q = 240\ N$ acting under an angle $\alpha = 60^{\circ}$ (Fig. A). Determine the magnitude of the resultant pull on the boat and the angle β and γ as shown in the figure. *Ans.* $R = 382\ N$, $\beta = 33^0$, $\gamma = 27^0$

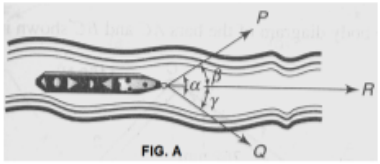

FIG. A

3. What force Q combined with a vertical pull $P = 6\ N$ will give a horizontal resultant $R = 8\ N$? *Ans. 10 N* inclined by $36^0 52'$

4. To move a boat uniformly along a canal at a given speed requires a resultant force $R = 400\ N$. This is accomplished by two horses pulling forces with forces P and Q on tow ropes, as shown in Fig. A. If the angle that the tow ropes make with the axis of the canal are $\beta = 35^{\circ}$ and $\gamma = 25^{\circ}$, what are the corresponding tensions in the ropes? *Ans.* $P = 195\ N$, $Q = 265\ N$

5. If, in Fig. A, the horses pull with the forces $P = 240\ N$ and $Q = 200\ N$, what must be the angles β and γ to give the resultant $R = 400\ N$? *Ans.* $\beta = 22^0 22'$, $\gamma = 27^0 12'$

6. A small block of weight $Q = 10\ N$ is placed on an inclined plane which makes an angle $\alpha = 30^{\circ}$ with the horizontal. Resolve the gravity force Q into two rectangular components Q_t and Q_n acting parallel and normal, respectively, to the inclined plane. *Ans.* $Q_t = 5N$, $Q_n = 8.66\ N$

[Turn over]

7. In level flight, the chord AB of an airplane wing makes an angle $\alpha = 5^{\circ}$ with the horizontal (Fig. B). The resultant wind pressure on the wing for such conditions is defined by its lift and drag components $L = 1500\ N$ and $D = 200\ N$, which are vertical and horizontal, respectively, as shown. Resolve this force into rectangular components X and Y, coinciding with the chord AB and its normal, respectively. *Ans.* $X = 68.5\ N$, $Y = 1511.7\ N$

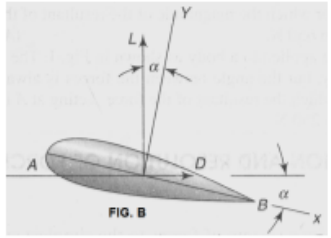

FIG. B

8. For the particular position shown in Fig. C the connecting rod BA of an engine exerts a force $P = 500$N on the crankpin at A. Resolve this into two rectangular components P_h and P_v acting horizontally and vertically, respectively, at A. *Ans.* $P_h = 468\ N$, $P_v = 177\ N$

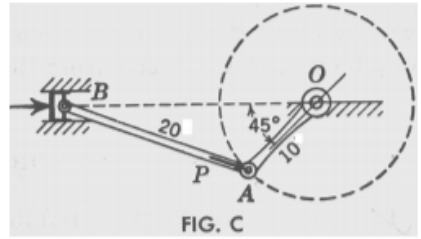

FIG. C

9. Resolve the force P in Fig. C into two rectangular components P_r and P_t acting along the radius AO and perpendicular therto, respectively. *Ans.* $P_r = 206\ N$, $P_t = 456\ N$

10. Determine analytically the magnitude and direction of the four forces shown in Fig. D. *Ans.* $R = 418\ N$, $\theta = 61^0 45'$

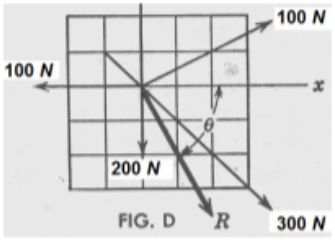

FIG. D

11. Determine graphically the magnitude and direction of the four con-current forces shown in Fig. D if each of the 100 N forces is increased to 150 N.

12. Determine graphically the magnitude and direction of the four con-current forces shown in Fig. D if each of the 100 N forces is reversed in direction.

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