Example 155. *The weights of four masses W_1, W_2, W_3 and W_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 20 cm, 15 cm, 25 cm and 30 cm respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance weight required if its radius of rotation is 20 cm.* (Baroda University, 1974)

Example 156. *A shaft carries three rotating masses A, B and C of weights 10, 12 and 15 kg and their radii of rotation are 6, 5 and 8 cm from the axis of the shaft. The planes of rotation of B and C are 50 and 80 cm from A and on the same side of it. The angular position of the masses B and C with respect to the mass A is 75° and 140° respectively. Determine the weight of the balancing masses in planes L and M and their angular positions with respect to A. The plane L is 20 cm to the left of the plane A and the plane M is 100 cm to the right of plane A. The radii of rotation of the balancing weights is 8 cm.* (Indore University, 1973)

Example 159. *An inside cylinder locomotive has its cylinder centre lines 70 cm apart and has a stroke of 60 cm. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 150 cm apart. The cranks are at right angles.*

The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by weights placed at a radius of 60 cm. Find the magnitude and direction of the balancing weights.

Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m. (U.P.S.C., Engg. Services, 1975)

Example 160 (S.I. Uints). *The three cranks of a three cylinder locomotive are all on the same axle and are set at 120°. The pitch of the cylinders is 1 metre and the stroke of each piston is 0·6 m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance weights are 0·8 m from the inside crank.*

If 40% of the reciprocating parts are to be balanced, find

(a) *the magnitude and position of the balancing masses required at a radius of 0·6 m ; and*

(b) *the hammer blow per wheel when the axle makes 6 r.p.s.*

(Jodhpur University, 1975)

Example 161. *The following data refer to two cylinder locomotive with cranks at 90°.*

Reciprocating mass per cylinder	= 300 kg
Crank radius	= 30 cm
Driving wheel diameter	= 180 cm
Distance between the cylinder centre lines	= 65 cm
Distance between the driving wheel central planes	= 155 cm

Determine : (a) *the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 4·6 tonnes at 96·5 km. p.h.*

(b) *the variation in tractive effort.*