UNIT 2
BALANCING
Balancing of Rotating Masses University Questions

1. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii of 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitude and angular Position.

2. Four masses A, B, C and D as given below are to be balanced.

		A	B	C	D
ii.	Mass (Kg)	30	50	50	-
iii.	Radius (mm)	180	240	120	150

3. The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°. B and C make angles of 210° and 120° respectively with D in the same sense. Find the magnitude and the angular positions of mass A and the position of planes A and D. (16)

4. A shaft carries four rotating masses A, B, C and D in this order along its axis. The mass of B, C and D are 30 kg, 50 kg and 40 kg respectively. The planes containing B and C are 30 cm apart. The angular spacing of the planes containing C and D are 90° and 210° respectively relative to B measured in the same sense. If the shaft and masses are to be in complete dynamic balance, find (i) the mass and the angular position of mass A; and (ii) the position of planes A and D.

5. A shaft carries four masses in parallel planes, A, B, C and D in this order along its length. This masses at B and C are 18 kg and 21.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 m and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine:
   - the magnitude of the masses at A and D ,
   - the distance between planes A and D and
   - The angular position of the mass at D.

6. A shaft is rotating at a uniform angular speed. Four masses m1, m2, m3 and m4 of magnitudes 300 kg, 450 kg, 360 kg, 390 kg respectively are attached rigidly to the shaft.

The masses are rotating in the same plane. The corresponding radii of rotation are 200mm, 150mm, 250mm and 300mm, respectively. The angles made by these masses with horizontal are 0°, 45°, 120", and 255° respectively. If the system is to be balanced by adding two balancing mass. Find

a. The magnitude of these balancing masses and
b. The position of the balancing mass if its radius of rotation is 200mm

7. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 700mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm, between X and Y is 400mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100mm, find their magnitudes and angular positions.

8. Four masses ml'm2' m3 and m4 attached to a rotating shaft on the same plane are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (10)
    a. Explain with neat sketches, balancing of a single revolving mass, by masses in two different planes in a rotating system. (6)

9. A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50 kg, 80 kg and 70 kg respectively. The masses C and D make angles of 90° and 195° respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75 mm, 100 mm, 50 mm and 90 mm respectively. The plane of rotation of masses B and C are 250 mm apart. Determine (i) the magnitude of mass A and its angular position and (ii) the position of planes A and D.

10. The three cranks of a three Cylinder in-line IC engine are all on the same axle and their cranks are set to 120°. The pitch of the Cylinder is 1 m 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 masses are 0.8 m from the inside crank. If 40 % of the reciprocating parts are to be balanced find the magnitude and the Position of the balancing masses required at a radius of 0.6 m and the hammer blow per wheel when the axle makes 6 r.p.s. (16)

11. The cranks and connecting rods of a four cylinder in-line engine running at 1800 rpm are 60 mm and 240 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order of 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine the unbalanced primary and secondary forces, if any, and unbalanced primary and secondary couples with reference to central plane of the engine. (16)