TIET Patiala

Department of Mechanical Engineering

UMT 304: Theory of Machines

Tutorial Sheet No 6

1. A rotating shaft carries three unbalanced masses of 4 kg, 3 kg and 2.5 kg at radial distances of 75 mm, 85 mm and 50 mm and at the angular positions of 45˚, 135˚ and 240˚ respectively. The second and third masses are in the places at 200 mm and 375 mm from the plane of the first mass. The angular positions are measured counter-clockwise from the reference line along x-axis and viewing the shaft from the first mass end. The shaft is 800 mm between bearings and the distance between the plane of the first mass and the bearing at that end is 225 mm. Determine the amount of the counter masses in planes at 75 mm from the bearings for the complete balance of the shaft. The first counter mass is to be in a plane between the first mass and the bearing and the second mass in a plane between the third mass and the bearing at that end.
2. A shaft supported in bearings that are 1.6 m apart projects 400 mm beyond bearings at each end. It carries three pulleys one at each end and one at the centre of its length. The masses of the end pulleys are 40 kg and 22 kg and their centres of mass are at 12 mm and 18 mm respectively from the shaft axes. The mass of the centre pulley is 38 kg and its centre of mass is 15 mm from the shaft axis. The pulleys are arranged in a manner that they give static balance. Determine the
   i. Relative angular positions of the pulleys
   ii. Dynamic forces developed on bearings when the shaft rotates at 210 rpm.
3. Four masses *A, B, C* and *D* are completely balanced. Masses *C* and *D* make angles of 90˚ and 195˚ respectively with that of mass *B* in the counter-clockwise direction. The rotating masses have the following properties: m_b = 25kg, m_c = 40 kg, m_d = 35 kg, r_a = 150 mm, r_b = 200 mm, r_c = 100 mm, r_d = 180 mm. Planes *B* and *C* are 250 mm apart. Determine the
   i. mass A and its angular position with that of mass *B*
   ii. Positions of all the planes relative to plane of mass *A*
4. A rotor has the following properties:

Mass	Magnitude	Radius	Angle	Axial distance from 1st mass
1	9 Kg	100 mm	0˚	
2	7 Kg	120 mm	60˚	160 mm
3	8 Kg	140 mm	135˚	320 mm
4	6 Kg	120 mm	270˚	560 mm

If the shaft is to be balanced by two counter masses located at 100 mm radii and revolving in planes midway of planes 1 and 2, and midway of 3 and 4, determine the magnitude of the masses and their respective angular positions.

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