

DYNAMICS OF MACHINERY

TUTORIAL - 3 (01/09/06)

Do not use any book as far as possible.

Time yourself and indicate the time required for solving each of the problems.

The solutions must be submitted on full scape paper, if you wish to get them corrected.

Only the first few who submit will have their papers checked. (50 Marks - 90 mins)

Units Covered : Balancing - Gyroscope

For Private Circulation Only

1a). A four cylinder vertical engine has cranks 225 mm long. The planes of rotation are arranged in the sequence 3-1-2-4. The distance between planes 3 and 1 is 600 mm, whereas that between planes 1 and 2 is 300 mm. The total distance between 3 and 4 is 1200 mm. The reciprocating masses of cylinders 1, 2 and 4 are 100 kg, 120 kg and 100 kg respectively. Find :

- The mass of the reciprocating parts for the third cylinder and
- The relative angular positions of the cranks in order that the engine may be in complete primary balance.

(8 marks)

1b). Explain with diagram, the procedure employed in dynamic balancing machines for balancing rotors.

(6 marks)

1c). Explain why complete balancing of primary unbalance in case of IC engines is not attempted.

(4 marks)

2a). The following data refers to a 90° two cylinder V-engine.

Mass of the reciprocating mass	=	2.5 kg
Length of crank	=	80 mm
Length of the connecting rod	=	320 mm
Engine Speed	=	2000 rpm

Find maximum primary and secondary unbalance. Solve by the direct and reverse crank concept.

(8 marks)

2b). A rotating shaft has 4 revolving unbalanced masses connected to it rigidly and revolving with it. The four masses A, B, C, D are arranged from left to right. The magnitude of unbalance masses are 20 kg, 10 kg, 25 kg and 16 kg respectively. The eccentricity of these masses are 20 mm, 10 mm, 25 mm and 16 mm respectively. The distances of planes of masses B, C and D measured from A are 130 mm, 320 mm and 500 mm respectively. Angular position of masses B, C and D measured from A are 60° , 260° and 45° respectively measured anticlockwise. Find the magnitude and position of two balance weight revolving at 50 mm radius in planes L and M such that their planes are at distances of 50 mm and 400 mm respectively; measured from plane A. Sequence of the planes thus is A – L – B – C – M – D.

(10 marks)

3a). Discuss the aspects of stability of a two wheeler taking a turn. Determine a relation to find the angle of heel in this case.

(6 marks)

3b). Inertia of a pair of locomotive driving wheels together with the shaft is 300 kgm^2 . The effective diameter of each wheel is 1.5 m and the mean track width is 1.5 m. The defect in the rail causes one wheel to fall 12 mm and rise again in a total time of 0.4 second, while the locomotive is travelling along a straight level track at 140 kmph. If the fall and rise of the wheel is with SHM, find the gyroscopic reaction couple on the locomotive.

(10 marks)