Exam.Code:0940
Sub. Code: 6713

2014

B.E. (Mechanical Engineering)
Fourth Semester
MEC-403: Dynamics of Machines

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

1. Attempt the following:-

(a) Why complete balancing is not possible in reciprocating engine?
(b) What is meant by reactive gyroscopic couple?
(c) What is condition for correct gearing?
(d) What is dynamically equivalent system?
(e) Define addendum and dedendum as related to gears (5x2=10)

Part-A

2. For a Hooke's joint connecting the driving and driven shafts, prove that

(a) ratio of angular velocities of the driven and driving shafts is given by

$$\frac{\omega_2}{\omega_1} = \frac{\cos\alpha}{1-\cos^2\theta\sin^2\alpha}$$

(b) speeds of these two shafts will be equal if, $\tan\theta = \pm\sqrt{\cos\alpha}$

(c) maximum speed of driven shaft = $\omega_1 / \cos\alpha$

(d) condition for maximum or minimum angular acceleration is given by

$$\cos\theta = \frac{2\sin^2\alpha}{2-\sin^2\alpha} \quad (10)$$

3. (a) Explain the effect of gyroscopic couple on reaction of the four wheels of a vehicle negotiating a curve. (5)

(b) Find the angle of inclination with respect to the vertical of two wheeler negotiating a turn. Given: combined mass of the vehicle with its rider 250 kg; moment of inertia of the engine flywheel 0.3 kg-m^2; moment of inertia of each wheel 1 kg-m^2; speed of engine flywheel 5 times that of road wheels and in the same direction; height of centre of gravity of rider with vehicle 0.6m; two wheeler speed 90 km/h; wheel radius 300mm; radius of turn 50m. (5)

P.T.O.

4. Draw the profile of cam to raise a valve with harmonic motion through 50mm in $\frac{1}{3}$ of revolution, keep it fully raised through $\frac{1}{12}$ revolution, and to lower it with harmonic motion in $\frac{1}{6}$ revolution. The valve remains closed during the rest of revolution. The diameter of the roller is 20mm and minimum radius of the cam is to be 25mm. The axis of the valve rod passes through the axis of the cam shaft. Assume the cam shaft to rotate with a uniform velocity. (10)

Part-B

5. A shaft carries four masses in parallel planes A, B, C and D in this order along its length. These masses at B and C are 18Kg and 12.5Kg respectively, and each has an eccentricity of 60mm. The masses at A and D have an eccentricity of 80mm. 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 100mm and that between B and C is 200mm. If the shaft is in complete dynamic balance, determine:
   1. the magnitude of the masses at A and D.
   2. the distance between planes A and D.
   3. the angular position of the mass at D. (10)

6. (a) Find an expression for minimum number of teeth (T) on the wheel if interference is to be avoided between two mating gears. Also find the above expression if gear ratio =1.
   (b) Calculate (i) length of path of contact, (ii) arc of contact and (iii) the contact ratio when a pinion having 23 teeth drives a gear having teeth 57. The profile of the gear is involute with pressure angle 20, module 8mm and addendum equal to one module. (10)

7. In an epicyclic gear train a gear C is keyed to the driving shaft A which rotates at 900r.p.m. Gear s D and E are fixed together and rotate freely on a pin carried by the arm M which is keyed to the driven shaft B. Gear D is in mesh with gear C while the gear E is in mesh with a fixed annular wheel F. The annular wheel is concentric with the driven shaft B. If the shafts A and B are collinear and number of teeth on gears C, D, E and F are respectively 21, 28, 14 and 84. Determine the speed and sense of rotation of the driven shaft B. (10)

x-x-x