1058

B.E. (Mechanical Engineering)
Fourth Semester
MEC-403: Theory of machines – II

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

I.   Attempt the following:-

   a) What is dynamically equivalent system ?

   b) What do you mean by steering gear mechanism?

   c) Explain the term "axis of precession" with reference to gyroscopic effect?

   d) How pressure angle can be defined in cams?

   e) Draw neat sketch of tangent cam?

   f) What are primary forces in balancing?

   g) What do you mean by tooth profiles, also write types of tooth profiles?

   h) Explain the term "face and flank of tooth"?

   i) What do you understand from the term Lower Pairs?

   j) Explain spiral angle in spiral gears? (10x1)

UNIT – I

II. In a four stroke petrol engine, the exhaust valve opens 45 degrees before t.d.c. and closes 15 degrees after the b.d.c. The valve has a lift of 12 mm. The least radius of circular-arc-type cam operating a flat-faced follower is 25mm. The nose radius is 3mm. The cam shaft rotates at 1500 rpm. Calculate the maximum velocity of the valve and minimum force exerted by spring to overcome the inertia of the moving parts that weigh 300 g. (10)

III. a) Drive fundamental equation for steering gears. Which steering gear fulfils this condition?

   b) In Hooke's joint, the angle between two shafts is 15 degrees. Find the angles fumed by driving shaft when velocity of driven shat is maximum, minimum and equal to that of the driving shaft. Also determine when the driven shaft will have maximum acceleration and retardation. (4,6)

P.T.O.

IV. A rail car has a total weight of 39240 N. There are two axles, each of which together with its wheels and gearing has a total moment of inertia of 30 kg-m^2. The centre distance between the two wheels on an axle is 1.5 m and each wheel is of 37.5 cm radius. Each axle is driven by a motor, the speed ratio between two being 1:3. Each motor with its gear has moment of inertia of 15 kg-m and runs in a direction opposite to that of axle. The centre of the gravity of car is 105 cm above the rails. Determine the limiting speed for this car when it is rounding a curve of 240 m radius such that no wheel leaves the rail. Consider the centrifugal and gyroscopic effects. (10)

UNIT – II

V. Two involute gears of 20 degrees pressure angle are in mesh. The number of teeth on pinion is 20 and gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find: angle turned through by pinion when one pair of teeth is in mesh, and the maximum velocity of sliding. (10)

VI. An Epicyclic gear train consists of a sun wheel S a stationary internal gear E and three identical planet wheels carried on a star-shaped planet carrier. The size of different toothed wheels are such that the planet carrier rotates at 1/5th of speed of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on sun wheel is 100 N-m. Determine 1. Number of teeth on different wheels of the train, and 2. Torques necessary to keep the internal gear stationary. (10)

VII. The successive cranks of a five cylinder in line engine are at 144 degrees apart. The spacing between cylinder centre lines are spaced at 500 mm. the cranks are at 60 degrees apart and firing order is 145236. The reciprocating mass per cylinder is 100 kg and the rotating parts are 50 kg per crank. Determine the out - of- balance forces and couples about the mid plane if engine rotates at 200 rpm. (10)

x-x-x