Fourth Semester B.Tech Degree Examination, Nov/Dec 2014

(2013 scheme)

Branch: Aeronautical Engineering

13.405 THEORY OF MACHINES

Time:**3** Hours Max.Marks:100

Instructions*: 1) Answer all questions from Part – A and three full questions from Part – B.*

2) Choosing not more than one question from each Module.

PART A

(Answer all questions, each question carries 2 marks)

1. Differentiate machine and structure.
2. Explain Grueblers criteria.
3. Define angle of repose with neat sketch.
4. Define circular pitch.
5. Write short note on Simple Harmonic Motion
6. List down the types of cam according to the follower motion.
7. What you mean by dynamic balancing?
8. Define swaying couple.
9. What is torsional vibration?
10. Explain critical speed of the shaft.

PART B

(Answer one question from each module, 20Marks each)

MODULE I

11 (a) explain any three inversions of single slider crank mechanism.

(b) Locate all the instantaneous centres for the crossed four bar mechanism as shown in the figure 1. The dimensions of various links are CD=65mm; CA=60mm; DB=80mm; and AB=55mm. find the angular velocities of the links AB and DB, if the crank rotates at100 rpm, in the anticlockwise direction.

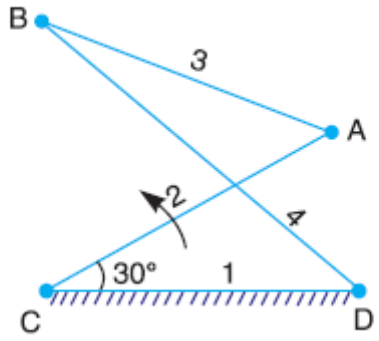

Fig-1

12 (a) Derive length and ratio of driving tensions for open belt drive.

(b) A centrifugal clutch is to transmit 15kW at 900 r.p.m. The shoes are four in number. The speed at which the engagement begins is 3/4th speed of running speed. The inside radius of the pulley rim is 150mm and the centre of gravity of the shoe lies at 120mm from the centre of the spider. The shoes are lines with ferrado for which the co-efficient of friction may be taken as 0.25. Determine 1. Mass of the shoes and 2. Size of the shoes, if angle subtended by the shoes at centre of spider is 60º and the pressure exerted on the shoe is 0.1N/mm^2.

MODULE II

13 (a) Explain Nomenclature of gear.

14 (a) Cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below :

1. To move outwards through 40 mm during 100° rotation of the cam ;
2. To dwell for next 80°
3. To return to its starting position during next 90°, and
4. To dwell for the rest period of a revolution i.e. 90°.

Draw the profile of the cam (i) when the line of stroke of the follower passes through the centre of the cam shaft, and (ii) when the line of stroke of the follower is off-set by 15 mm. The displacement of the follower is to

take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m.

Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

MODULE III

15 (a) A shaft has three eccentrics, each 75 mm diameter and 25 mm thick, machined in one piece with the shaft. The central planes of the eccentric are 60 mm apart. The distance of the centres from the axis of rotation are 12 mm, 18 mm and 12 mm and their angular positions are 120° apart. The density of metal is 7000 kg/m3. Find the amount of out-of-balance force and couple at 600 r.p.m. If the shaft is balanced by adding two masses at a radius 75 mm and at distances of 100 mm from the central plane of the middle eccentric, find the amount of the masses and their angular positions

16 (a) An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles.

The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses.

Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m

MODULE 1V

17(a) Derive natural frequency of free transverse vibrations for a shaft subjected to anumber of point loads by using i) Energy method ii) Dunkerley's method

18(a) A shaft of length 0.75 m, supported freely at the ends, is carrying a body of mass 90 kg at 0.25 m from one end. Find the natural frequency of transverse vibration. Assume E = 200 GN/m2 and shaft diameter = 50 mm.

(b)Explain critical speed of the shaft.