Seat No: - _____

Ganpat University
B. Tech. Sem. III Mechanical Engineering
CBCS Regular Examination Nov./Dec.-2012
2ME304 Kinematics of Machines

[Time: 3 Hour] [Total marks: 70]

Instructions:

(1) Attempt all questions.
(2) Right figure indicate full marks.
(3) Assume suitable data if necessary.
(4) Only scientific calculator is allowed.

SECTION-I

Que.1

(A) Define following terms: [3]
(i) Machine (ii) Degree of freedom (iii) Kinematic chain

(B) What do you mean by Inversion? Enlist inversions of double slider and explain any one. [4]

(C) Explain the condition for correct steering of a four wheeler with sketch. [5]

OR

Que.1

(A) What do you understand by constrained motion? Explain different types of constrained motion. [3]

(B) Explain the Davis steering gear mechanism. [4]

(C) What are the different inversions of a four bar chain mechanism? Explain with neat sketch the working of any one inversion. [5]

Que.2

(A) Define instantaneous centre of a link and state its properties. [2]

(B) Define: Lower pair. Also explain Scott Russel mechanism with neat sketch. [3]

(C) In a slider crank mechanism, the crank is 480 mm long and rotates at 20 rad/s in the counter clockwise direction. The length of the connecting rod is 1600 mm. When crank turns 60° from the inner dead centre , determine: [7]
(i) Velocity of slider
(ii) Velocity of a point E located at a distance 450 mm from the connecting rod extended,
(iii) The position and the velocity of a point F on the connecting rod having the least absolute velocity,
(iv) The angular velocity of the connecting rod.

OR

Que.2

(A) Explain the term space centrode and body centrode. [3]

(B) What are the straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch. [4]

(C) ABCD is a four bar chain with links AD fixed. The length of the links are AB = 62.5 mm, BC = 175 mm, CD = 112.5 mm and AD = 200 mm. The crank AB rotates at 10 rad/s clockwise. Draw the velocity diagram when angle BAD = 60° and B and C lie on the same side of AD. Find the angular velocity of links BC and CD. [5]

Que.3

(A) Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity again followed by a dwell period. The cam has a least radius of 25 mm. [09]

(B) Define following. (Any two) [02]
(i) Lift (ii) Pitch point (iii) Pressure angle

SECTION – II

Que:4

(A) Define: Angle of repose and Angle of friction. **[3]**

(B) Derive expression for the friction torque considering uniform wear for a flat collar bearing. **[4]**

(C) An effort of 1500 N is required to just move a certain body up an inclined plane of angle 12°, force acting parallel to the plane. If the angle of inclination is increased to 15° then the effort required is 1720 N. Find the weight of the body and the coefficient of friction. **[5]**

OR

Que:4

(A) What are different kinds of friction? **[3]**

(B) Deduce an expression for the efficiency of an inclined plane when a body moves down a plane. **[4]**

(C) A thrust bearing of a propeller shaft consists of a number of collars. The shaft is of 420 mm diameter and rotates at a speed of 100 rpm. The thrust on the shaft is 290 kN. If the intensity of pressure is to be 200 kN/m^2, and the coefficient of friction is 0.06, determine external diameter of the collars and the number of collars. The power lost in friction is not to exceed 50 kW. **[5]**

Que:5

(A) What should be the characteristics of the material used for brake lining? **[3]**

(B) Describe with neat sketch the principle of operation of differential band brake. Also derive the expression of force applied for the same. **[4]**

(C) As shown in **fig.-1**, a band and block brake, having 12 blocks each of which subtends an angle of 13° at the centre, is applied to the drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. the two ends of the band are attached to the pins on opposite side of the brake lever at distance of 30 mm and 120 mm from the fulcrum. Take $\mu = 0.3$. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find: **[5]**

(i) Maximum braking torque,

(ii) Angular retardation of the drum.

(iii) Time taken by the system to come to rest from the rated speed of 360 rpm.

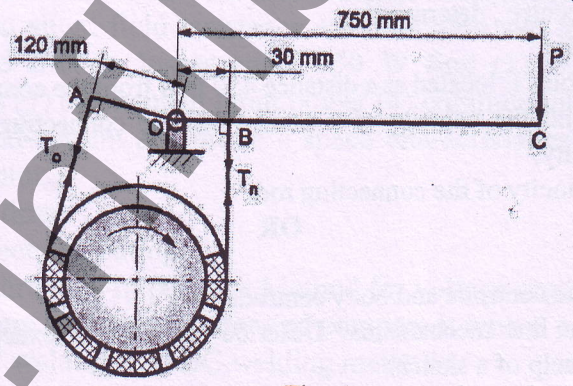

Fig.-1

OR

Que:5

(A) What is difference between absorption and transmission dynamometer? Explain rope brake dynamometer with neat sketch. **[3]**

(B) Derive an equation of retardation of vehicle, when the vehicle is moving up on an inclined plane and the brakes are applied to front wheels. **[4]**

(C) A car moving on a level road at a speed of 60 km/hr has a wheel base 2.76 m, distance of C.G. from ground level is 500 mm, and distance of C.G. from rear wheels is 1.10 m. Find the distance travelled by the car before coming to rest when brakes are applied, **[5]**

(i) To rear wheels, (ii) To front wheels, (iii) To all the four wheels.

The coefficient of friction between road surface and tyre is 0.5.

Que:6

(A) What do you understand by 'gear train'? Enlist the various types of gear trains. **[2]**

(B) Explain with neat sketch, differential gear in automobile. **[4]**

(C) An epicyclic gear consists of three gears A, B and C as shown in **fig.2.** The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 rpm. If the gear A is fixed, determine the speed of gear B and C. **[5]**

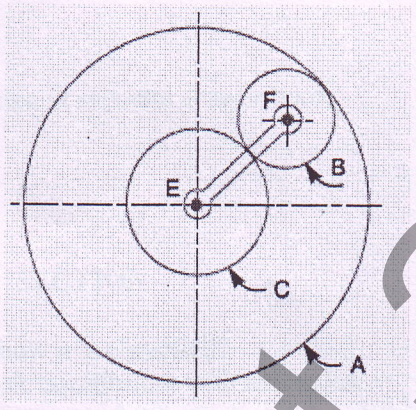

Fig.-2

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