Ganpat University

B.Tech SEM III Mechatronics Engineering
Regular Examination November / December 2012
2MC304/ MC302 Kinematics

Duration: 3hr   **Marks: 70**

Instructions:
1. Assume suitable data if necessary.
2. Write your answer to the point and precisely.
3. Draw neat and clean sketch.

SECTION - 1

Q.1   **Attempt following questions**

(a) The speed ration of the reverted gear train as shown in **figure - A** is to be 10.   [07]
The module pitch of gears A and B is 3 mm and gears C and D is 2.5 mm.
calculate the suitable number of teeth for the gears. No gear is to have less
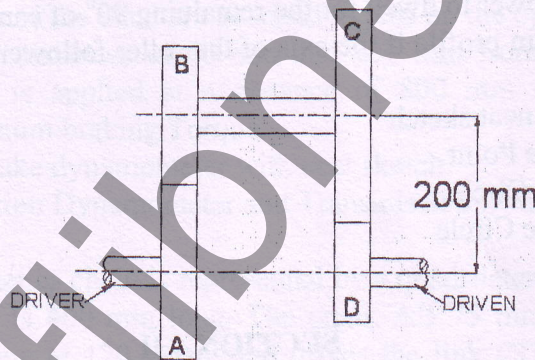than 24 teeth.

Figure. – A

(b) Define gear train? Explain various types of gear trains.   [02]
(c) Explain Epicyclic gear train with neat sketch   [03]

OR

Q.1   **Attempt following questions**

(a) In a reverted epicyclic train, the arm F carries two wheels A and D and a   [09]
compound wheel B-C. The Wheel A and the Wheel B and the wheel D
meshes with Wheel C. The numbers of teeth on wheel A, D and C are 80, 48
and 72 respectively. Find the speed and direction of wheel D when wheel A is
fixed and arm F makes 200 r.p.m clockwise.

(b) Define Gear Train. Explain varies types of Gear Train with neat sketch.   [03]

Q.2   **Attempt following questions**

(a) Define correct steering? Prove that **tan α = C / 2b** for Davis steering gear   [06]
mechanism.

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(b) Evaluate Following [04]
    (i) Lower pair and Higher pair
    (ii) Regid body and Resistant body
(c) Define Turing pair with Application [01]

<div align="center">OR</div>

Q.2   **Attempt following questions**

(a) Explain Hart's mechanism with neat sketch. Also Prove that the tracing point [06] describes a straight line path

(b) Define Inversion? State all inversion of single slider crank mechanism. [05]

Q.3   **Attempt following questions**

(a) A cam with 30 mm as minimum diameter is rotating clock –wise at a uniform [09] speed of 1200 r.p.m. and has to give the following motion to a roller follower 10 mm in diameter:
    (i) Follower to complete outward stroke of 25 mm during 120^0 of cam rotation with equal uniform acceleration and retardation.
    (ii) Follower of dwell for 60^0 of cam rotation.
    (iii)Follower to return to its initial position during 90^0 of cam rotation with uniform acceleration and retardation.
    (iv)Follower to dwell for the remaining 90^0 of cam rotation.
Draw the cam profile if the axis of the roller follower passes through the axis of cam.

(b) Define with neat sketch [03]
    (i) Trace Point
    (ii) Base Circle
    (iii)Prime Circle

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SECTION – II

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Q.4   **Attempt following questions**

(a) Figure B shows a differential band brake of drum diameter 400 mm. The two [07] ends of the band are fixed to the points on the opposite side of fulcrum of the lever at a distance 50 mm and 150 mm from the fulcrum. The brake is to sustain a torque of 300 Nm. The co-efficient of friction between band and the brake is 0.2. Determine
    (i) The force required at the end of lever for the clockwise and anti clockwise rotation of the drum.
    (ii) Value of OA for the brake to be self locking for clockwise rotation.
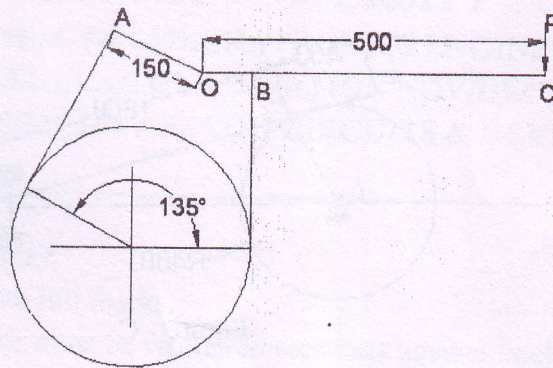
<div align="center">2</div>

Figure - B

(b) Explain Rope Brake Dynamometer with neat sketch [04]

(c) Evaluate Brake and Clutch [01]

OR

Q.4 **Attempt following questions**

(a) A band and block brake having 12 blocks, each of which subtends an angle [07] of 16^0 at the centre, is applied to a rotating drum of diameter 500 mm. The blocks are 70 mm thick. The drum and the flywheel mounted on the same shaft have a mass of 1500 kg and have a combined radius of gyration of 500 mm. the two ends of the band are attached to pins on the opposite sides of the brake fulcrum at distances of 40 mm and 150 mm from the fulcrum. If a force of 250 N is applied at a distance of 800 mm from the fulcrum. Determine maximum braking Torque.

(b) Explain Prony brake dynamometer with neat sketch. [03]

(c) Evaluate Absorption Dynamometer and Transmission Dynamometer [02]

Q.5 **(a)** A four bar kinematics chain is represented by a quadrilateral ABCD in which [06] AD is fixed and is 400 mm long. The crank AB 75 mm long rotates in a clockwise direction at 120 r.p.m. and drives the link CD 125 mm long by means of the connectinf link BC 350 mm long. Determine angular velocities of the links BC and CD in one of the positions when BC is perpendicluar to AB.

(b) The crank of a slider crank mechanism is 15 cm and the connecting rod is 60 [05] cm long. The crank makes 300 r.p.m. in the clockwise direction. When it has turned 45^0 from the inner dead centre position, determine acceleration of the mid point of the connecting rod.

OR

Q.5 **(a)** For the configuration of a slider crank mechanism shown in figure C, [11] calculate

   (i) The acceleration of the slider at B

   (ii) The acceleration of Point E

   (iii)The acceleration of link AB.
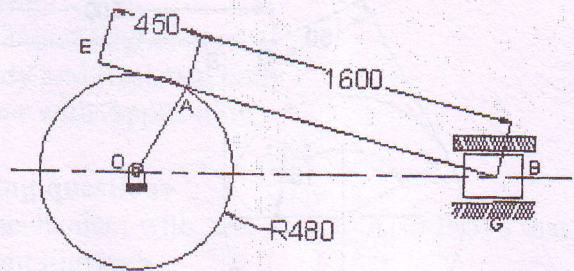
OA rotates at 20 rad /s counter clockwise.

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Figure - C

Q.6   **Attempt following questions**

(a) Define Static Friction and Dynamic Friction [02]

(b) Evaluate Film friction and Dry friction [02]

(c) A load of 25 KN is supported by a conical pivot with angle of cone 120^0. The intensity of pressure is not exceed 350 KN/m^2. The external radius is 2 times the internal radius. The shaft is rotating at 180 r.p.m. and co-efficient of friction is 0.05. Find the power absorb in friction assuming uniform pressure. [04]

(d) A shaft has a number of collar integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. if the intensity of pressure is 0.35 N/mm^2 (uniform) and the co-efficient of friction is 0.005. Estimate – [04]

     (i) Power absorb when the shaft runs at 105 r.p.m. carrying a load of 150 KN and

     (ii) Number of Collar required.

END OF PAPER