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SET - 1

II B. Tech II Semester Regular Examinations, April - 2018
KINEMATICS OF MACHINARY
(Com to ME, AME, MIN)

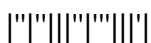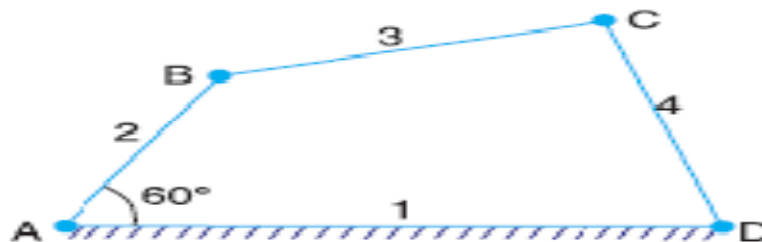Time: 3 hours   Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

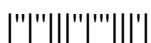1. a) Write a short note on complete and incomplete constraints in lower pair and higher pairs, depict your answer with neat sketches   (3M)

    b) What is a panatograph?   (3M)

    c) What is the Coriolis acceleration component?   (2M)

    d) State the reasons for providing offset in a cam follower mechanism.   (2M)

    e) What is the advantages when arc of recess is equal to arc of approach gears.   (2M)

    f) How is the epicyclic gear train works?   (2M)

PART -B

2. a) Discuss various types of constrained motion.   (7M)

    b) What is Kutzback's criterion for degree of freedom of plane mechanisms? In what way is Grubler's criterion different from it?   (7M)

3. a) Sketch a Paucellier mechanism. Show that it can be used to trace a straight line.   (7M)

    b) Derive an expression for the ratio of angular velocities of the shafts of a Hooke's joint.   (7M)

4. a) Explain the procedure to construct Klein's construction to determine the velocity and acceleration of a slider-crank mechanism.   (7M)

    b) Locate all the instantaneous centres for a four bar mechanism as shown in figure. The lengths of various links are : AD=125 mm; AB=62.5 mm ; BC=CD=75 mm. If the link AB rotates at a uniform speed of 10 rpm in the clockwise direction, find the angular velocity of the links BC and CD.   (7M)

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5. a) What is a cam? What type of motion can be transmitted with a cam and follower combination? What are its elements. (7M)

    b) A tangent cam with straight working faces tangential to a base circle of 120 mm diameter has a roller follower of 48 mm diameter. The line of stroke of the roller follower passes through the axis of the cam. The nose circle radius of the cam is 12 mm and the angle between the tangential faces of the cam is 90^0. If the speed of the cam is 180rpm, determine the acceleration of the follower when (i) during the lift, the roller just leaves the straight flank.
(ii) the roller is at the outer end of its lift, i.e., at the top of the nose. (7M)

6. a) What is interference? Derive the relation for the minimum number of teeth for a pair of involute profile of teeth to avoid interference. (7M)

    b) Compare cycloidal and involute gear tooth profile. (7M)

7. a) Deduce an expression for the ratio of tight and slack side tensions in case of V-belt drive. (7M)

    b) An epicyclic gear consist of a pinion, a wheel of 40 teeth and an annulus with 84 internal teeth concentric with the wheel. The pinion gears with the wheel and the annulus. The arm that carries the axis of the pinion rotates at 100rpm. If the annulus is fixed, find the speed of the wheel, if wheel is fixed, find the speed of the annulus. (7M)

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PART –A

1. a) Define Grubler's criteria for a mechanism.   (3M)

    b) State an application of Peaucellier mechanism.   (2M)

    c) Define instantaneous centre.   (2M)

    d) Why a roller follower is preferred to that of a knife-edged follower?   (2M)

    e) What is meant by interference and undercutting of gears?   (3M)

    f) What are the special advantages of epicyclic gear trains?   (2M)

PART -B

2. a) Give the classification of kinematic pairs (lower pairs) according to type of   (7M)
        relative motion between links. Also indicate the degree-of-freedom associated
        with each pair.

    b) What are the inversions of mechanism? Sketch the inversions of slider crank   (7M)
        chain and name the mechanisms obtained.

3. a) What is Scott-Russel mechanism? What is its limitation? How is it modified?   (7M)

    b) Explain why two Hooke's joints are used to transmit motion from the engine to (7M)
        the differential of an automobile.

4. a) What is the Coriolis acceleration component? In which cases does it occur?   (7M)
        How is it determined?

    b) Locate all the instantaneous centres of the slider crank mechanism as shown in   (7M)
        figure. The lengths of crank OB and connecting rod AB are 100 mm and
        400mm respectively. If the crank rotates clockwise with an angular velocity of
        10 rad/s, find i) Velocity of the slider A and ii).Angular velocity of the
        connecting rod AB.

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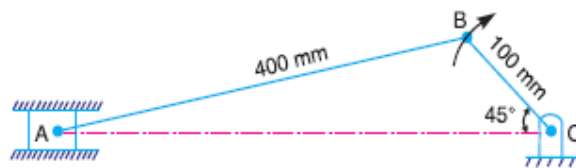
5. a) Deduce expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion.   (7M)
    b) Derive relations for velocity and acceleration for a convex cam with a flat-faced follower.   (7M)

6. a) State and prove law of gearing.   (7M)
    b) Two 20^0 involute spur gears mesh externally and give a velocity ratio of 3.The module is 3 mm and the addendum is equal to 1.1 module. If the pinion rotates at 120rpm, determine the (i) minimum number of teeth on each wheel to avoid interference (ii) contact ratio.   (7M)

7. a) 2.5 kW of power is transmitted by an open-belt drive. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165^0.The coefficient of friction is 0.3.Detrmine the effect on power transmission in the following cases: i) Initial tension in the belt is increased by 8%.   (7M)
            ii). Initial tension in the belt is decreased by 8%.
    b) Explain reverted type gear train with sketch.   (7M)
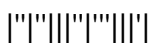
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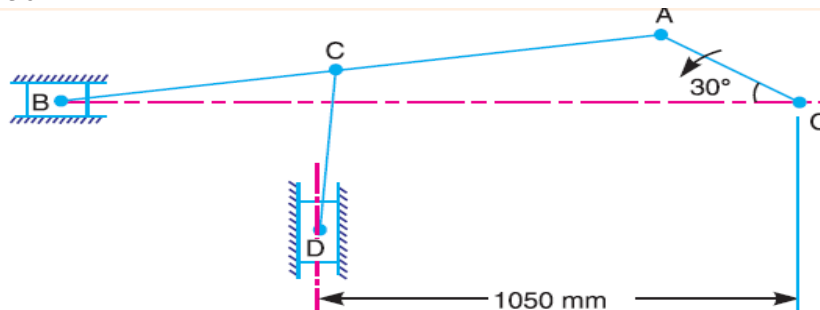Time: 3 hours   Max. Marks: 70

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PART –A

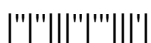1. a) Differentiate the rigid and flexible links.   (2M)

    b) What is Hooke's joint.   (2M)

    c) What do you mean by centrode of a body?   (2M)

    d) Classify cams based on their physical shape.   (3M)

    e) What do you understand by the term interference as applied to gears?   (2M)

    f) Write mathematical expression for the length of the belt required for two   (3M)
        pulleys of diameters d_1 and d_2 and at distance x apart are connected by means
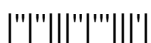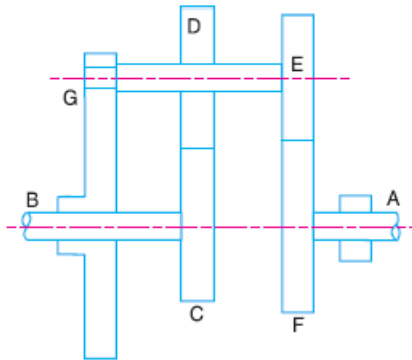   of an open belt drive.

PART -B

2. a) Define 'kinematic pair' and 'degree of freedom'. Sketch 'Spherical pair' and   (7M)
        state its degree of freedom.
    b) Explain with a neat sketch, the double slider crank chain mechanism and its   (7M)
        inversions.

3. a) What is pantograph? Show that it can produce paths exactly similar to the ones   (7M)
        traced out by a point on a link on an enlarged or a reduced scale.
    b) What is the condition for correct steering? Sketch and explain Davis Steering   (7M)
        gear mechanism.

4. a) In the mechanism, as shown in Fig., the crank OA rotates at 20 r.p.m.Anti   (7M)
        clockwise and gives motion to the sliding blocks B and D. The dimensions of
        the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD =
        450 mm

    b) State and prove the 'Aronhold Kennedy's Theorem' of three instantaneous   (7M)
        centres.

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5. a) Deduce expressions for the velocity and acceleration of the follower when it   (7M)
        moves with simple harmonic motion.
    b) Explain Convex circular arc cam with neat sketch.   (7M)

6. a) Derive an equation to determine the length of path of contact by a pair of   (7M)
        mating spur gear.
    b) Two 20^0 involute spur gears have a module of 10 mm. The addendum is one   (7M)
        module. The larger gear has 50 teeth and the pinion has 13 teeth. Does
        interference occur? If it occurs, to what valve should the pressure angle be
        changed to eliminate interference?

7. a) Discuss the effect of slip of belt on the pulleys on the velocity ratio of a belt   (7M)
        drive
    b) In an epicyclic gear train, as shown in figure, the wheel C is keyed to the shaft   (7M)
        B and   wheel F is keyed to shaft A. The wheels D and E rotate together on a
        pin fixed to the arm G. The number of teeth on wheels C, D, E and F are
        35,65,32 and 68 respectively. If the shaft A rotates at 60 rpm and the shaft B
        rotates at 28 rpm in the opposite   direction, find the speed and direction of
        rotation of arm G.

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PART –A

1. a) Classifications of machines. (3M)

   b) What are the applications of Universal coupling? (2M)

   c) State different types of instantaneous centres. (2M)

   d) Define trace point of a cam. (2M)

   e) Define normal and axial pitch in helical gears. (2M)

   f) Write the conditions for the maximum power transmission by a belt from one pulley to another. (3M)

PART -B

2. a) Discuss various types of constrained motion. (7M)

   b) How is the Whitworth quick-return mechanism and crank slotted-lever mechanism different from each other? Explain. (7M)

3. a) Explain with a neat sketch, Pantograph mechanism. State its applications. (7M)

   b) What is an automobile steering gear? What are its types? Which steering gear is preferred and why? (7M)

4. a) Explain how by means of klein's construction the acceleration of a reciprocating engine is determined. (7M)

   b) What is instantaneous centre of rotation? State Kennedy's theorem. (7M)

5. a) What is a cam? What type of motion can be transmitted with a cam and follower combination? What are its elements? (7M)

   b) The following data is related to a symmetrical circular arc cam operating a flat-faced follower. Least radius of the cam=27.5 mm, total lift= 12.5 mm, angle of lift=55^0, nose radius=3mm speed of cam=600 rpm. Find (7M)
   i).Distance between cam centre and nose centres,
   ii). radius of circular flank,
   iii). angle of contact on the circular flank.

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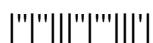
6. a) Derive an expression for length of path of contact, length of arc contact and contact ratio for a pair of involute gears in contact. (7M)

 b) A pair of bevel gears is mounted on two intersecting shafts whose shaft angles are at 72^0 to each other. The velocity ratio of the gears is 2. Find the pitch angles. (7M)

7. a) The centre-to-centre distance between the two sprockets of a chain drive is 600 mm. The chain drive is used to reduce4 the speed from 180rpm to 90 rpm on the driving sprocket has 18 teeth and a pitch circle diameter of 480 mm. Determine the (7M)
 i) Number of teeth on the driven sprocket.
 ii) Pitch and length of the chain.

 b) What is a differential gear of an automobile? How does it function? Explain. (7M)

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