B.E.(with Credits)-Regular-Semester 2012-Mechanical Engineering Sem III
ME 303 - Kinematics of Machines

P. Pages : 4

Time : Three Hours

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0932

GUG/S/18/3792

Max. Marks : 80

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Notes : 1.   All questions carry equal marks.
2.   Answer Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q. 9 or 10.
3.   Due credit will be given to neatness and adequate dimensions.
4.   Assume suitable data wherever necessary.
5.   Illustrate your answers wherever necessary with the help of neat sketches.
6.   Discuss the reaction, mechanism wherever necessary.
7.   Use of non-programmable calculator and drawing instrument is permitted.

1.   a)   Explain Gruebler's criteria for degree of freedom for planar mechanism.   **4**

b)   Differentiate between.   **6**

i)   Lower and higher pair.

ii)   Turning and screw pair.

iii)   Rolling and spherical pair.

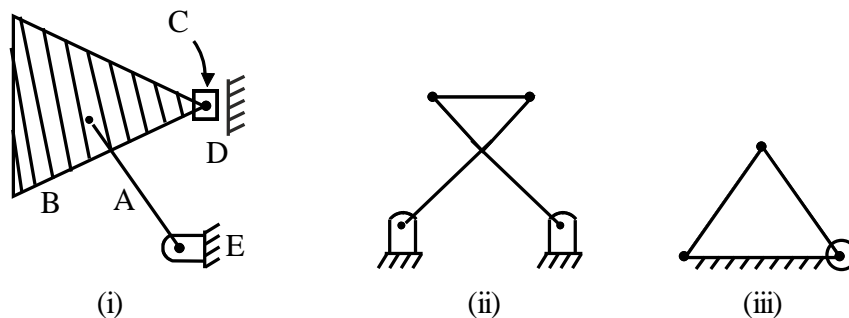c)   Determine the degree of freedom of the mechanism shown in fig. 1c.   **6**

Fig. 1 c

OR

2.   a)   What do you understand by inversion of mechanisms? List various inversion of a four bar   **6**
chain.

b)   Explain following mechanisms.   **10**

i)   Geneva wheel.

ii)   Hart mechanism for accurate straight line motion.

3.　　In the crank and slotted lever type quick return motion mechanism as shown in fig. 3, the crank AB rotates at 120 r.p.m. Determine.　　**16**
a)　Velocity of ram at 'D'
b)　Magnitude of Coriolis acceleration component and
c)　Acceleration of ram at 'D'.
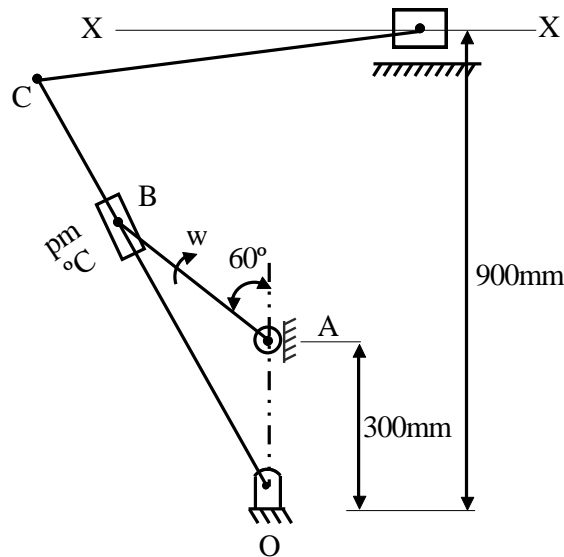　　AB = 200 mm, OC = 800 mm, CD = 600 mm OA = 300 mm.

Fig. 3

OR

4.　a)　What is instantaneous center? Discuss instantaneous center with respect to following conditions.　　**8**
i)　For pivoted or pin joint.
ii)　For pure rolling contact of the links.
iii)　In sliding motion.

　　b)　Locate the instantaneous centers of the slider crank mechanism as shown in fig. 4 b find the velocity of slider, OA = 160 mm, AB = 470 mm and OB = 600 mm, $W_2 = 12$ rad/sec clockwise.　　**8**
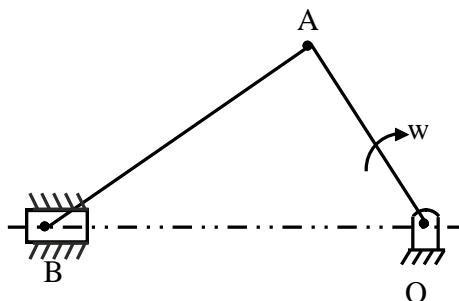

Fig. 4 (b)

5.　a)　What are the different types of followers and cams. (Draw neat sketches)　　**4**

　　b)　Explain following terms with neat sketches related to cam and follower.　　**4**
i)　Base circle　　　　　　　　　ii)　Prime circle
iii)　Cam angle　　　　　　　　　iv)　Pressure angle

c) A disc cam with circle radius 50 mm is operating a roller follower with SHM. The lift is 25 mm, angle of ascent 120º, dwell 60º, return 90º and dwell during remaining period. The roller radius is 10 mm. Draw Displacement and cdm profile diagrams when line of reciprocation of follower passes through the cam axis.　　**8**

OR

6. The following data relate to a circular arc cam operating a flat faced follower'　　**16**
least diameter = 40 mm
Lift = 12 mm
Angle of action = 160º
Speed = 500 rpm
If the period of acceleration of the follower is 60% of the retardation during the lift, determine the
i) Main dimensions of the cam
ii) Acceleration at the main points. What is the maximum acceleration and deceleration during the lift.

7. a) Compare involute tooth profile with cycloidal tooth profile.　　**2**

b) What is interference and undercutting for involute profile teeth. What are the methods to avoid it.　　**4**

c) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gear is involute with 20º pressure angle, 12 mm module and 10 mm addendum.　　**10**
Find
　　i) Length of path of contact.
　　ii) Arc of contact and
　　iii) The contact ratio.

OR

8. a) What is the law for velocity of sliding between a gear pair? Explain with sketch.　　**4**

b) A pair of 20º pressure angle gears in mesh has following data.　　**12**
Speed of pinion = 400 rpm.
Number of teeth on pinion = 24
Number of teeth on gear = 28
Module = 10 mm
Determine addendum of the gears if the path of approach and recess is half the maximum value. Determine also the arc of contact and the maximum velocity of sliding between the mating surfaces.

9. a) What are the drawbacks of worm gear drive over other type of gear drives?　　**2**

b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with 40 teeth gear. The helix angle is 25º and the normal pressure angle is 20º. The normal module is 3 mm. calculate.　　**6**
　　i) The transverse module.
　　ii) Axial pitch.
　　iii) The PCD of pinion and gear.
　　iv) The center distance.

c) A three start worm has a pitch diameter of 80 mm and a pitch of 20 mm. It rotates at 600 r.p.m and drives a 40 teeth worm gear. If the coefficient of friction is 0.05 find. **8**
   i) The helix angle.
   ii) Center distance.
   iii) Efficiency.
   iv) The speed of gear.

OR

10. a) What is epicyclic or planetary gear train? What is its advantage? **4**

b) An epicyclic gear consists of three gears A,B and C as shown in fig. 10 b. 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 center of A at 18 r.p.m. If the gear A is fixed, determine the speed of gear B and C. **12**
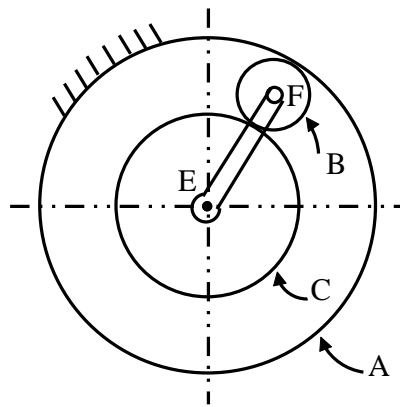
Fig. 10. b

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