Register Number .....

B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Fourth Semester

MECHANICAL ENGINEERING

U07ME402: Kinematics of Machinery

Time: Three hours **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. **Ackermann** steering mechanism used in vehicles is obtained by .....
   a) Inversion of four bar chain b) inversion of single slider crank chain
   c) Double slider crank chain d) straight line mechanism
2. All lower pairs are.....
   a) Unclosed b) Closed c) Open d) Spherical
3. The period during which the follower remains at rest is called.....
   a) Outstroke b) Return strokec) Dwell d) acceleration
4. What is the maximum acceleration of a follower moving with simple harmonic motion during out stroke?
   a) $a_{O}=\frac{\pi^2\omega^2 S}{2\theta_O^2}$ b) $a_{O}=\frac{\pi^2\omega^2 S}{4\theta_O^2}$ c) $a_{R}=\frac{\pi^2\omega^2 S}{4\theta_O^2}$ d) $a_{R}=\frac{\pi^2\omega^2 S}{4\theta_O^2}$
5. In the four bar chain, considering mechanical advantage of 0.7 f_B=35N, what is the force acting on pin C.
   a) 35N b) 24.5N c) 30N d) 32N
6. How many instantaneous centres are possible in a four bar chain mechanism.....
   a) 4 b) 8 c) 6 d) 2
7. Two intersecting and coplanar shafts are connected by gear
   a) Worm b) hypoid c) Bevel d) Spiral
8. A toothed wheel has 112 teeth. Its module is 1.75. Then the value of circular pitch is .....
   a) 196mm b) 5.5mm c) 0.57mm d) 4.2mm
9. The device which is used to engage and disengage power from the engine to the rest of system is.....
   a) Gear b) lever c) Clutch d) shaft
10. The mechanical efficiency of an inclined plane which needs son of force to raise a block on its surface when it is purely lubricated and 65N when the surface is dry is.....
    a) 70.2% b) 76.9% c) 80.4% d) 84.7%

PART B (10 x 2 = 20 Marks)

11. What are the some important inversions of four bar chain mechanism?
12. Give some examples of kinematic pairs.
13. Define instantaneous centre and instantaneous axis.
14. A pin joints two links A and B, A rotates with ω_A angular velocity and B rotates with ω_B angular velocity in opposite direction. What is the rubbing velocity of that pin?
15. What is a cam?
16. Define tangent cam.
17. State law of Gearing.
18. Define Backlash
19. What is difference between cone clutch and centrifugal clutch?
20. What is mean by angle of contact (lap angle)?

PART C (5 x 14 =70 Marks)

21. a)Sketch and describe the working of whit worth quick return mechanisms. Derive an expression for the ratio of time taken in forward and return stroke for this mechanism.

(OR)

b) Sketch and explain straight line motion generating mechanism.

22. a) The dimensions and configuration of the four bar mechanism, shown in Fig1, are as follows P1A=300mm, P1B=360mm; AB=360mm and P_1P_2=600mm. The angle $AP_1P_2 = 60$ crank P_1A has an angular velocity of 10 rad /sec and an angular acceleration of 30 rad/s Clockwise. Determine the angular velocity and angular accelerations of P_2B and AB and velocity and acceleration of the joint B.

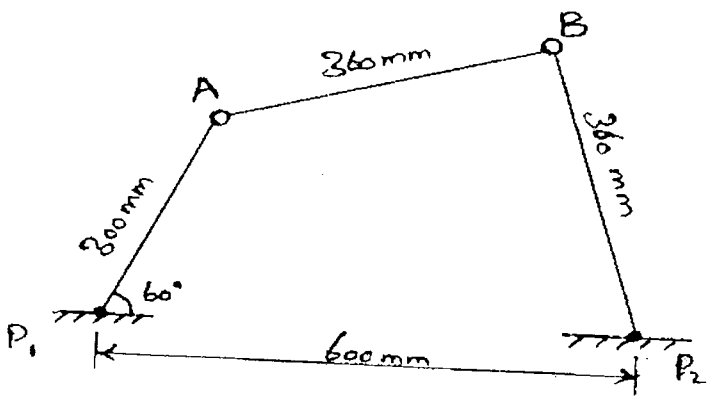

Fig.1

(OR)

the mechanism, as shown in Fig2, the crank OA rotates at 20 revolutions per minutes anticlockwise and gives motion to the sliding blocks B and D. The dimensions of various links are OA=300mm; AB=1200mm, BC=450mm and CD=450mm. For the given configuration Determine

(i) the velocity of sliding at B and D

(ii) Angular velocity of CD

(iii) Linear acceleration of D

(iv) Angular acceleration of CD

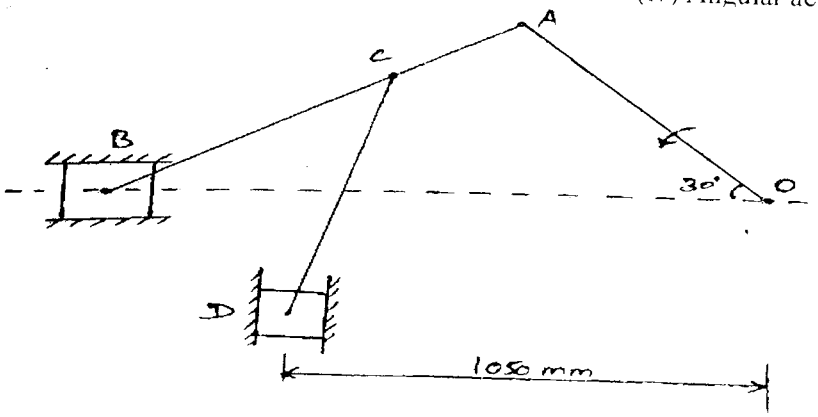

Fig.2

23. a) A cam rotating clockwise at a uniform speed of 100rpm is required to give motion to knife edge follower as below:

i) Follower to move outwards through 25mm during 120^0 of cam rotation

ii) Follower to dwell for the next 60^0 of cam rotation.

iii) Follower to return to its starting position during next 90^0 of cam rotation

iv) Follower to dwell for the rest of the cam rotation.

The minimum radius of cam is 50mm and the line of stroke of the follower passes through the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, find the maximum velocity and acceleration during its outstroke and return stroke. Also draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

(OR)

b) A tangent cam with a base circle diameter of 50mm operates a roller follower 20mm in diameter. The line of stroke of the roller passes through the axis of cam. The angle between the tangential faces of the cam is 60^0, speed of the cam shaft 250 r.p.m and the lift of the follower 15mm. calculates:

1) The main dimensions of the cam.

2) The accelerations of the follower at

(i) The beginning of the lift

(ii) Where the roller just touches the nose

(iii) The apex of the circular nose

24. a) A pinion having 20 involute teeth of module pitch 6mm rotates at 200 revolutions per min transmits 1.5 kW to a gear wheel having 50 teeth. The addendum on both the wheel is li circular pitch. The angle of obliquity is 20^{0}. Find (i) the length of the path of approach; length of the arc of approach; (iii) the normal force between the teeth at an instant where only pair of teeth in contact.

(OR)

b) In an epicyclic gear train an annular wheel A having 54 teeth meshes with a planet wheel B gears with a Sun wheel C, the wheels A and C being co-axial. The wheel B is carried on fixed on one end of arm P which rotates about the axis of the wheels A and C. If the wheel makes 20 r.p.m in a clockwise sense and the arm rotates at 100rpm in the anticlockwise di and the wheel C has 24 teeth, determine the speed and sense of rotation of wheel C.

25. a) An open belt running over two pulleys of 1.5m and 1.0 m diameters connects two parallel 4.80m apart. The initial tension in the belt is 3000N. The smaller pulley is rotating at 6 The mass of belt is 0.6703 kg/m length. The coefficient of friction between the belt and pul 0.3 find:

(i) The exact length of the belt required, and

(ii) The power transmitted taking centrifugal tension into account

(OR)

b) The external and internal radii of a friction plate of a single clutch are 120mm and 1 respectively. The friction surfaces are held together with a total axial thrust of 1500 uniform wear, find the maximum, minimum and average pressure on the contact surface.

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Time

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