B.E. DEGREE EXAMINATIONS: NOV/DEC 2012

Third Semester

MECHATRONICS ENGINEERING

MCT101: Kinematics of Machinery

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A kinematic chain is known as a mechanism when

    a)   None of the links is fixed   b)   one of the links is fixed

    c)   two of the links are fixed   d)   all of the links are fixed

2. Which of the following is an inversion of single slider crank chain?

    a)   Coupling rod of locomotive   b)   Pendulum pump

    c)   Elliptical trammels   d)   Oscillating cylinder engine

3. The coriolis component of acceleration is taken into account for

    a)   Slider crank mechanism   b)   Four bar mechanism

    c)   Quick return motion mechanism   d)   None of these

4. When a slider moves on a fixed link having curved surface ,their instantaneous centre lies

    a)   On their point of contact   b)   At the centre of curvature

    c)   At the centre of circle   d)   At the pin joint

5. The cam follower extensively used in air-craft engines is

    a)   Knife edge follower   b)   Flat faced follower

    c)   Spherical faced follower   d)   Roller flower

6. For high speed engines ,the cam follower should move with

    a)   Uniform velocity   b)   Simple harmonic motion

    c)   Uniform acceleration and retardation d)   Cycloidal motion

7. The type of gears used to connect two non –parallel non – intersecting shafts are

    a)   Spur gears   b)   Helical gears

    c)   Spiral gears   d)   Bevel gear

8. The train value of gear train is

    a)   Equal to velocity ratio of a gear train   b)   Reciprocal of velocity ration of a gear train

    c)   Always greater than unity   d)   Always less than unity

9. The frictional torque transmitted by a disc or plate clutch is same as that of

    a)   Flat pivot bearing   b)   Flat collar bearing

    c)   Conical pivot bearing   d)   Trapezoidal pivot bearing

10. When the belt is stationary, it is subjected to some tension, known as initial tension. the value of this tension is equal to the

    a) Tension in the tight side of the belt   b) Tension in the slack side of the belt

    c) Sum of the tensions in the tight side and slack side of the belt   d) Average tension of the tight side and slack side of the belt

PART B (10 x 2 = 20 Marks)

11. Define the degree of freedom of a pair.

12. List out the types of kinematic chains

13. What is configuration diagram?

14. Explain (i) tangential acceleration (ii) radial acceleration

15. Write the classification of followers according to the surface in contact.

16. Sketch the cam with offset follower

17. What are the advantages and disadvantages of gear drive?

18. Write the different types of gear trains depending upon the arrangement of wheels.

19. Define coefficient of friction.

20. What are the various important factors upon which the selection of belt drive depends?

PART C (5 x 14 = 70 Marks)

21. a)   Explain with neat sketch of Whitworth quick return motion mechanism.

(OR)

    b)   Briefly explain the application of Kutzbach Criterion to plane mechanisms.

22. a)   An engine mechanism is shown in fig.1 the crank CB=100 mm and the connecting rod BA = 300 mm with centre of gravity G,100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2 .Find : 1.Velocity of G and angular velocity of AB ,and 2.Acceleration of G and angular acceleration of AB.
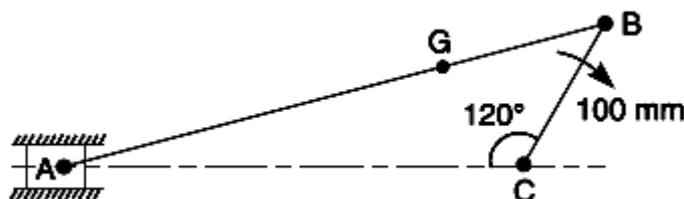

Fig .1

(OR)

b) The dimensions of the mechanism as shown in fig.2 are as follows AB= 0.45m BD=1.5 m BC = CE = 0.9m
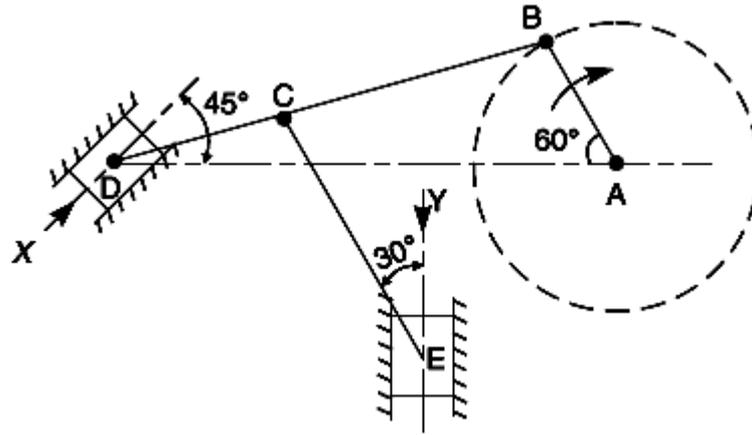

Fig (2)

The crank AB turns uniformly at 180 r.p.m in the clock wise direction and the blocks at D and E are working in frictionless guides. Draw the velocity diagram for the mechanism and find the velocities of the sliders D and E in their guides. Also determine the turning moment at A if a force of 500N acts on D in the direction of arrow X and a force of 750N acts on E in the direction of arrow Y.

23. a) A cam drives a flat reciprocating follower in the following manner. During first 120^0 rotation of the cam,follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30^0 of cam rotation. During next 120^0 of cam rotation. the follower moves inwards with simple harmonic motion. The follower dwells for the next 90^0 of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

(OR)

b) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 r.p.m. calculate 1. The principal dimensions of the cam2.the accelerations of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent.

24. a) A pair of 20^0 full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh .the smaller gear rotates at 1000 r.p.m. Determine 1.Sliding velocities at engagement and at disengagement of pair of a teeth and 2.contact ratio

(OR)

b) An epicyclic gear consists of three gears A, B and C as shown in fig 3.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 r.p.m. If the gear A is fixed ,determine the speed of gears Band C.
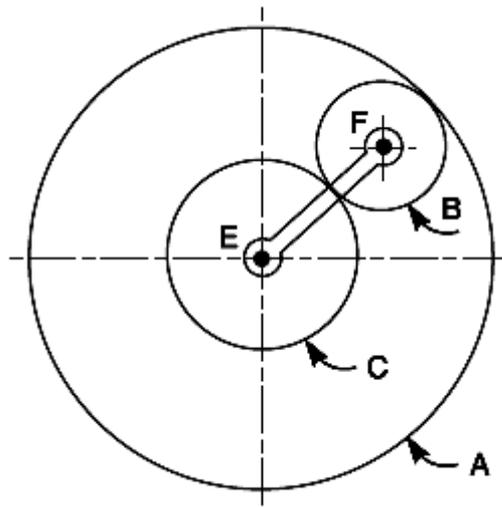

Fig (3)

25. a) A single dry plate clutch transmits 7.5 kw at 900 r.p.m. The axial pressure is limited to 0.07 N/mm^2.If the coefficient of friction is 0.25, find 1. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4 and 2. Outer and inner radii of the clutch plate.

(OR)

b) (i) Derive the expression of velocity ratio of belt drive. (7)

(ii) Explain the slip of the belt and derive the expression (7)

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