B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2014

MECHANICAL ENGINEERING

THIRD SEMESTER

ME 8302 KINEMATICS OF MACHINES

(REGULATION 2012)

Time : 3 hr. Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1 Define kinematic link, and a kinematic chain

2 What is mechanical advantage for a mechanism?

3 What is rubbing velocity and how this is determined?

4 Differentiate between self locking and self energizing brake.

5 What is a tangent cam?

6 What is an offset follower?

7 Explain the terms : (i) Module, & (ii) Pressure angle.

8 Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ?

9 What is centrifugal tension in a belt? How does it affect the power transmitted?

10 Explain the following :
(i) Limiting friction, and (ii) Angle of friction.

PART B (5 x 16 = 80 Marks)

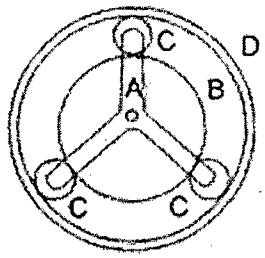
11 A cam drives a flat reciprocating follower in the following manner :
During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum

radius of the cam is 25 mm. Draw the profile of the cam. (16)

12a A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. (16)

[OR]

12b In an epicyclic gear of the 'sun and planet' type shown in Fig. below, the pitch circle diameter of the internally toothed ring is to be 224 mm and the module 4 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable numbers of teeth for all the wheels.



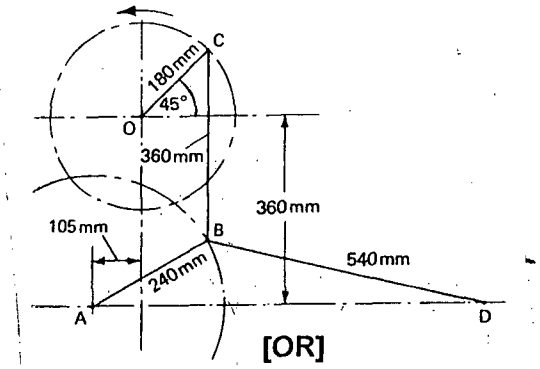
(16)

13a A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m., assuming 1. Uniform pressure; and 2. Uniform wear. (16)

[OR]

13b Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? (16)

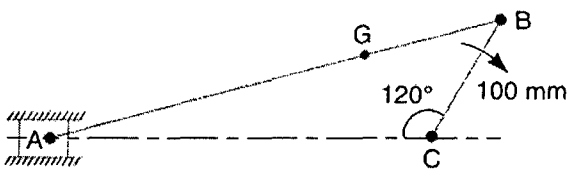
14a In the mechanism shown below, D is constrained to move on a horizontal path. Find, for the given configuration, the velocity and acceleration of D and the angular velocity and acceleration of BD when OC is rotating in an anticlockwise direction at a speed of 180 rev/min increasing at the rate of 50 rad/s^2.



(16)

[OR]

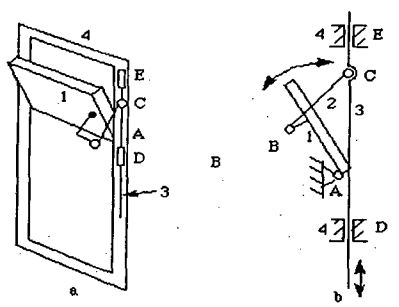
14b An engine mechanism is shown in Fig. below. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find:1. Velocity of G and angular velocity of AB, and 2. Acceleration of G and angular acceleration of AB.



(16)

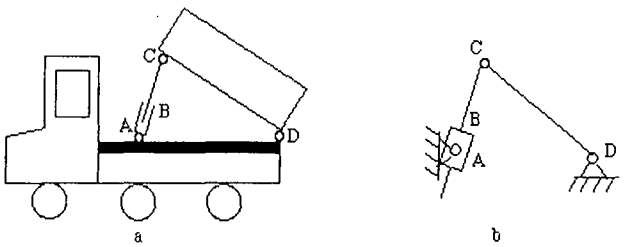
15a Calculate the degrees of freedom of the mechanism shown below

(i) Transom mechanism -The opening and closing mechanism



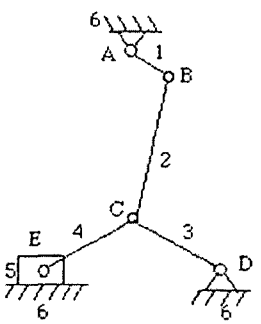
(4)

(ii) **Dump truck**



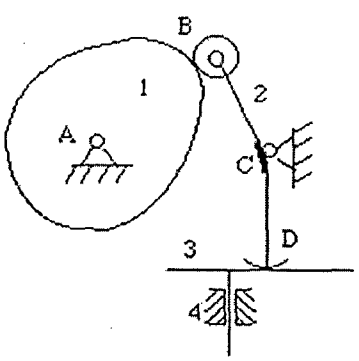
(4)

(iii) **Kinematic chain - 1**



(4)

(iv) **Kinematic chain - 2**



(4)

[OR]

15b What is meant by a kinematic inversion? Explain kinematic inversion with regard to a crank slider mechanism. (16)