JAYA GROUP OF INSTITUTIONS-THIRUNINRAVUR

4th SEM– B.E. / B.Tech

INTERNAL ASSESSMENT-1(MODEL EXAM-1)

Sub. Name: MECHANICS OF MACHINES Date: 30-01-2015

Sub. Code: AT 6302 Branch: Aeronautical

Duration: 180 minutes Max.Marks: 100

PART-A (10 x 2 =20)

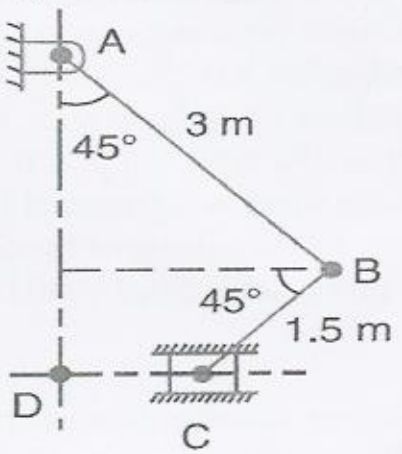
1. Define mechanism.Define the Grublers mechanism for plane mechanism
2. Enumerate the difference between a Machine and a Structure. Give some example
3. Sketch the velocity and acceleration profile of a follower which moves with SHM
4. Why is a roller follower preferred to that of a knife edged follower?
5. Define the terms Kinematic chain and kinematic pair
6. Define limiting angle of friction and angle of repose
7. Define slip and creep in belt
8. What is meant by crowning of pulley with regards to belts used for power transmission?
9. Give the condition for maximum power transmission in flat belts.
10. State the functional difference between a brake and clutch

PART-B (5x16=80)

11 (a) In a four bar chain ABCD, link AD is fixed and is 600 mm apart and the crank AB rotates at 10 rad/sec and an acceleration of 30 rad/sec^2 both clockwise direction. Lengths of the links are AB = 300 mm, BC = CD =360 mm. When angle BAD = 60 deg. And both B and C lie on the sameside of AD, Find angular velocities and angular acceleration of BC and CD and velocity and acceleration of joint C.

OR

11 (b) In the mechanism shown in below, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2.The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. Determine: **1.** The magnitude of vertical and horizontal component of the acceleration of the point B, and **2.** the angular acceleration of the links AB and BC



12 (a) Draw the profile of cam which raises a valve with SHM through 3cm in 1/3 revolution keep it fully raised through 1/12 revolution and it is closed in next 1/3 revolution with SHM. The valve remains closed during the rest of the revolution. The diameter of the roller is 1cm and the minimum radius of the cam is 2cm, the axis of the valve rod is offset by 1cm from the axis of cam shaft.

OR

12(b) Construct the profile of a cam to suit the following specifications : Cam shaft diameter = 40 mm ; Least radius of cam = 25 mm ; Diameter of roller = 25 mm;Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two of equal interval between motions.During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

13(a) (i) ExplainWhitworth quick return motion mechanism and Crank and slotted lever quick return motion mechanism(8)

(ii)In a crank and slotted lever quick return motion mechanism, the distance between the fixed centers is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever (8)

OR

13(b) The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine :**1.** velocity of piston, **2.** angular velocity of connecting rod, **3.** velocity of point E on the connecting rod 1.5 m from the gudgeon pin, **4.** velocities of rubbing at the pins of the crank shaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, **5.** position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft

14 (a)(i) 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, ifthe maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25?

(ii)A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30°. The cross-sectional area of each belt is 750 mm2 and μ. = 0.12. The density of the belt material is 1.2 Mg/m3 and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys 300 mm diameter rotating at 1500 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be maximum.

OR

14(b) (i) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 4 kW from the smaller pulley that rotates at 300

.m. Coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10N per mm width. Determine: **1.** minimum width of the belt, **2.** initial belt tension, and **3.** length of the belt required.

(ii) A rope drive transmits 600 kW from a pulley of effective diameter 4 m, which runs at a speed of 90 r.p.m. The angle of lap is 160° ; the angle of groove 45° ; the coefficient of friction 0.28 ; the mass of rope 1.5 kg / m and the allowable tension in each rope 2400 N. Find the number of ropes required.

15 (a) (i) A multi-disc clutch has three discs on the driving shaft and two on thedriven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter120 mm.Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressurebetween the discs for transmitting 25 kW at 1575 r.p.m.

(ii) A square threaded bolt of root diameter 22.5 mm and pitch 5 mm is tightened by screwing a nut whose mean diameter of bearing surface is 50 mm. If coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface 0.16, find the force required at the end of a spanner 500 mm long when the load on the bolt is 10 kN.

OR

15 (b) (i) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear.

(ii) The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5mm. The coefficient of friction between the screw and the nut is 0.13. Determine the torque required on the screw to raise a load of 25 kN, assuming the load to rotate with the screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load and also the efficiency of the machine.