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Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, February 2015
(2013 Scheme)
Branch : Mechanical Engineering
Stream : Machine Design
MDC 1002 : ADVANCED THEORY OF MECHANISMS

Time : 3 Hours Max. Marks : 60

Instructions : *1) Answer **any two** questons from **each** Module.*

*2) **Each** question carries **10** marks*

Module – I

1. The link AB of the mechanism shown in fig. 1 is driven counter clockwise and its position is defined by the general function $\theta(t)$. Bar BC slides through the collar at D. The collar at 'D' is free to pivot about D. Determine the velocity and acceleration of point C if r = 200 mm, L = 1.5 m, a = 1.2 m at $\theta = 130°$, $\dot{\theta} = 180$ r.p.m, $\ddot{\theta} = 0.25$ rad/s^2.

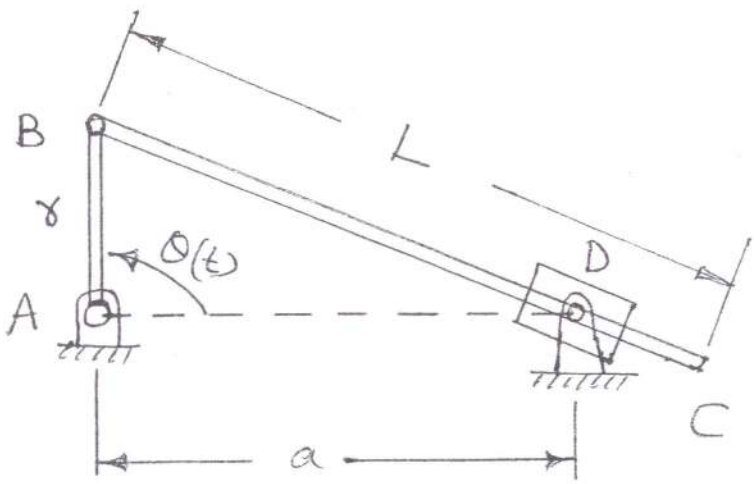

Fig. 1

2. Find the inflection circle for the motion of the link '3' of the mechanism shown in fig. 2 and determine the radius of curvature of the path traced by the point 'C'.

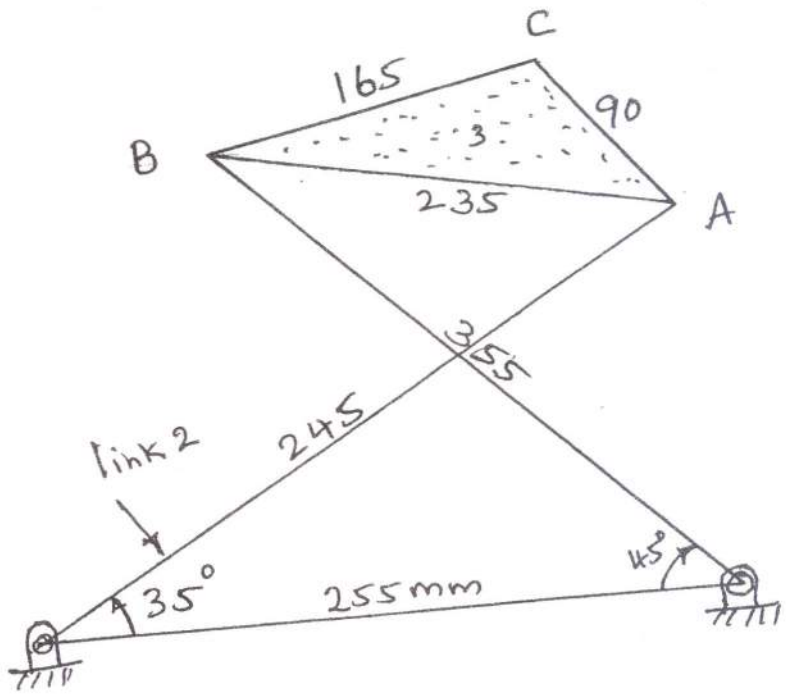

Fig. 2

3. a) State and prove Roberts law of cognate linkages.
   b) Explain cubic of stationary curvature.

Module – II

4. Design a double lever mechanism to satisfy the following :

   Input angles $\theta_{12} = 40°cw$, $\theta_{13} = 85°cw$, $\theta_{14} = 120°cw$, output angles $\phi_{12} = 25°cw$, $\phi_{13} = 37°cw$, $\phi_{14} = 45°cw$, and fixed frame length = 75 mm. What is the minimum transmission angle for the Mechanism ?

5. A cam follower system is driven through a rise of 50 mm with simple Harmonic motion in 150° of cam rotation. The cam rotates at a speed of 1350 r.p.m. and has a dwell on each side of rise. The follower is loaded against the cam by 50 N/mm compression spring initially compressed to a distance of 10 mm. Taking the weight of the follower as 10 kg and stiffness as 800 N/mm. Calculate the response of the system. Does jump occurs ?

6. A pair of parallel helical gears is used to transmit 6 kw power at 1440 r.p.m. The normal module is 6 mm, the normal pressure angle is 20° and helix angle is 30°. The gear ratio is 5. The number of teeth on pinion is 20. The pinion and gear are having right handed and left handed teeth respectively. Determine the total force, Radial component, axial component and the tangential force.

Module – III

7. Three gears A, B and C are arranged as shown in fig. 3. Each of the gears A and B have a mass of 675 gm and has a radius of gyration of 40 mm, while gear C has a mass of 3.6 kg and has a radius of gyration of 100 mm. Assume that kinetic friction in the bearings of gears A, B and C produces couples of constant magnitude 0.15 Nm, 0.15 Nm and 0.3 Nm respectively. If the initial angular velocity of gear C is 2000 r.p.m. determine the time required for the system to come to rest.

Fig. 3

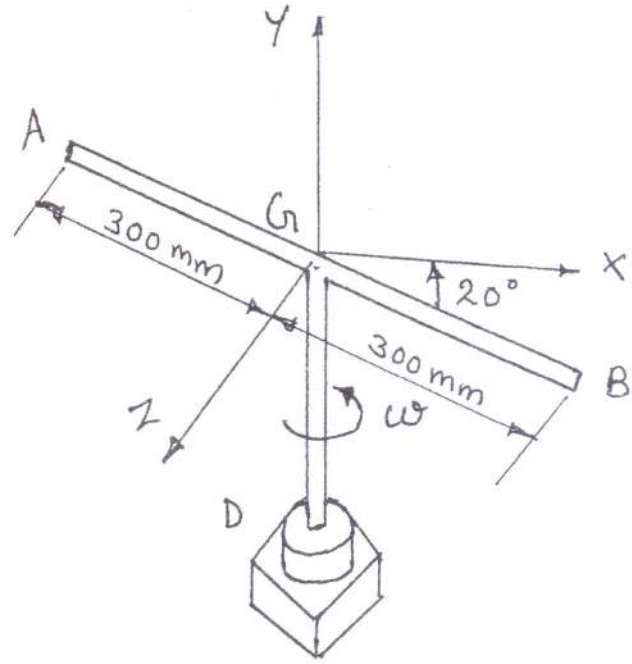

Fig. 4

8. A uniform rod AB of 1.8 kg is welded at its mid piont G to a vertical shaft GD as shown in fig. 4. If the shaft rotates with an angular velocity of ω = 1200 r.p.m (constant), determine the angular momentum HG of the rod about G.

9. A uniform thin disc of 150 mm diameter is attached to the end of a rod AB of negligible mass which is supported by a ball and socket joint at point A as shown in fig. 5. The disc is spinning about its axis of symmetry AB at the rate of 2100 r.p.m in the sense indicated and that AB forms an angle of 45° with the vertical axis AC; Determine the two possible rates of steady precession of the disc about the axis AC.

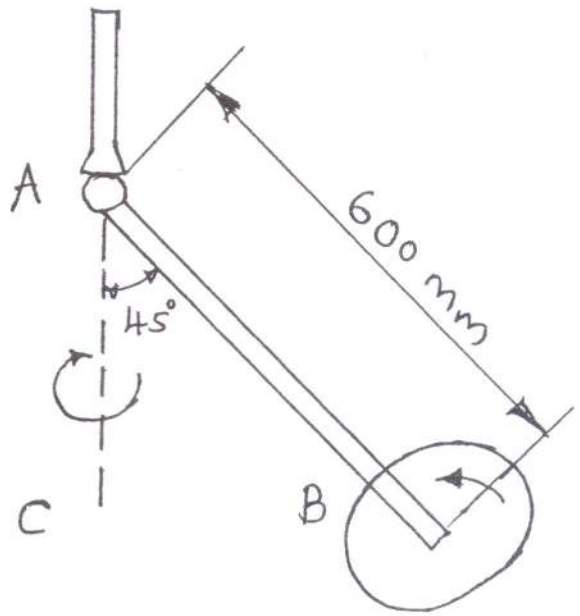

Fig. 5