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**D – 4668**

Reg. No. : .....

Name : .....

**Fifth Semester B.Tech. Degree Examination, January 2018  
(2013 Scheme)**

**13.502 : THEORY OF MACHINES (MP) ME**

Time : 3 Hours

Max. Marks : 100

***Instruction : Answer all the questions.***

**PART – A**

**(10×2=20 Marks)**

1. Differentiate between analysis and synthesis.
2. State Grubler's criterion for plane mechanism.
3. What do you mean by instantaneous centers ?
4. What is the advantage of self-expanding shoe brake ?
5. Why does a cone clutch transmit more power than a plate clutch ?
6. List the methods that may be used to reduce the pressure angle of the cam.
7. What do you mean by law of gearing ? Define conjugate action.
8. What is the significance of contact ratio in gear drive ?
9. Define the term 'Belt Creep'.
10. What do you mean by crowning of pulley ?

**P.T.O.**



Module - I

11. i) Examine the chains shown in Figure 1 below and indicate whether these are kinematic chains or not. 12

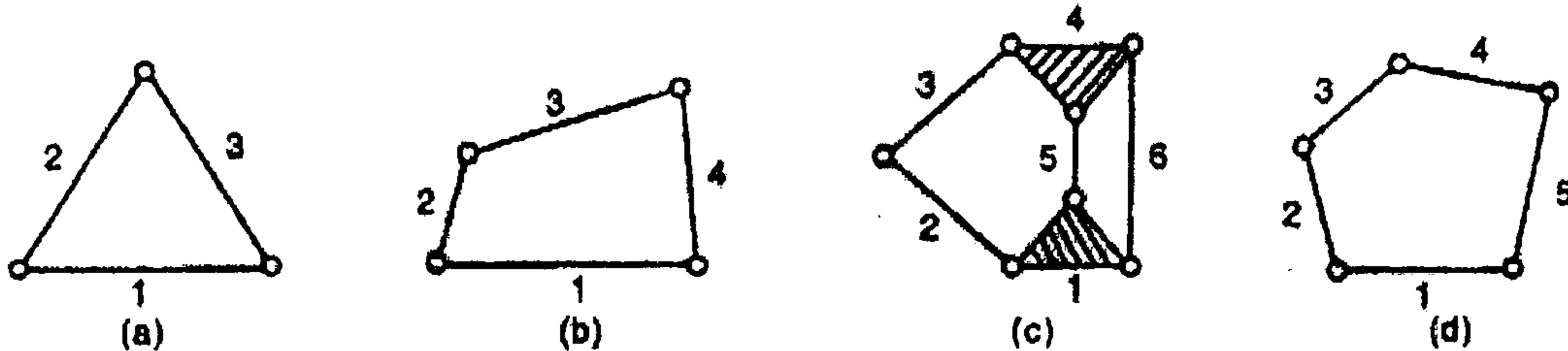


Figure 1 Kinematic chains

- ii) Describe elliptical trammel. How does it enable us to describe a true ellipse? 8

OR

12. i) A linkage has 14 links and the number of loops is 5. Calculate its degrees of freedom, number of joints and maximum number of ternary links that can be had. Assume that all the pairs turning pairs. 10
- ii) Explain with the help of neat sketch a double slider crank and its inversion. 10

Module - II

13. Figure 2 shows the link mechanism of a quick-return mechanism, the various dimensions of which are, OA : 400 mm, OP : 200 mm, AR : 700 mm, RS = 300 mm. OA = 400 mm, OP = 200 mm, AR = 700 mm, RS = 300 mm  $\angle AOP = 100^\circ$ . For the configuration shown determine the acceleration of the cutting tool at S and the angular acceleration of the link.

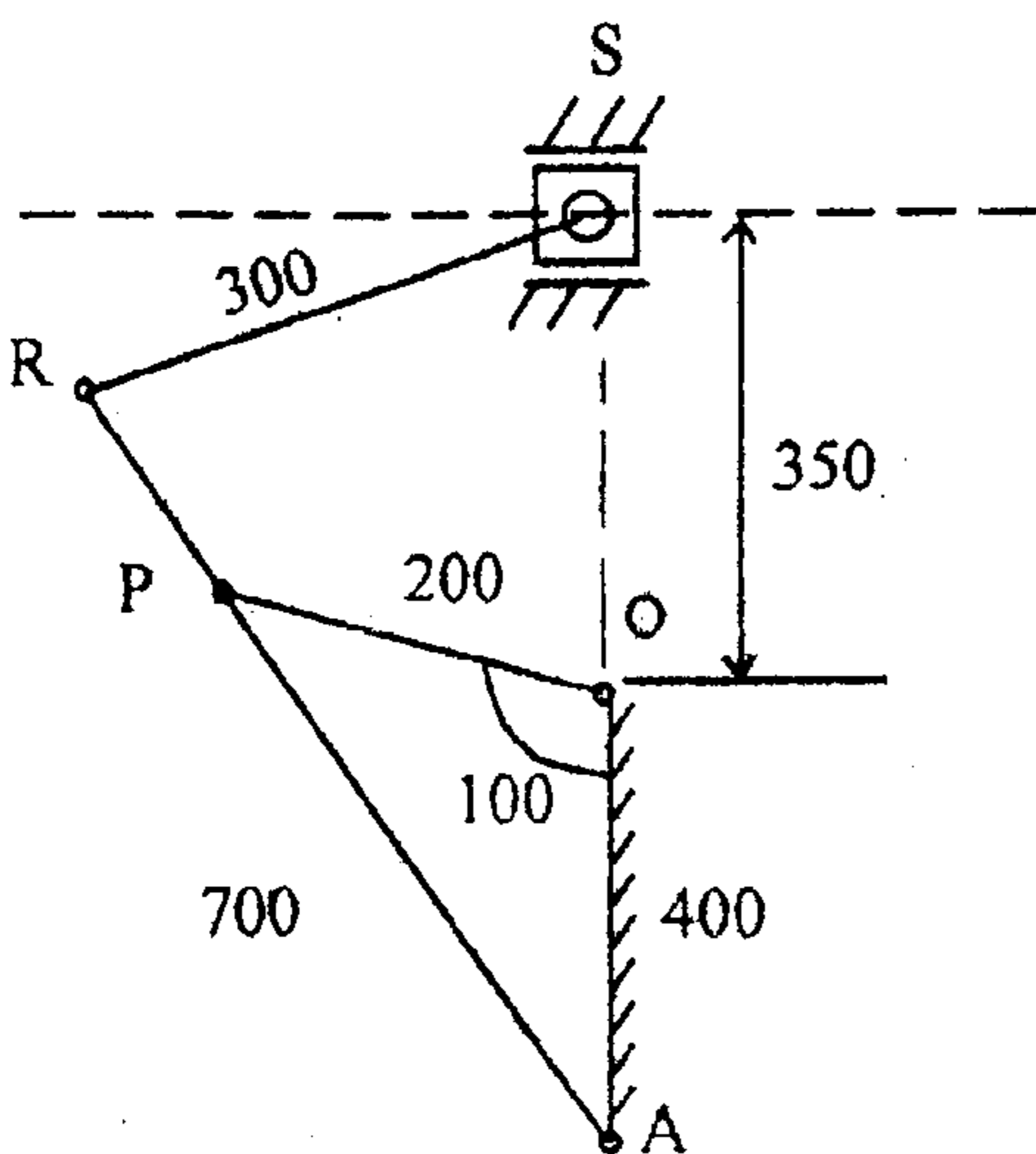


Figure 2

OR



14. The engine mechanism shown in Figure 3 has crank  $OB = 50$  mm and Length connecting rod  $AB = 225$  mm. The centre of gravity of the rod is at  $G$ , which is  $75$  mm from  $B$ . The engine speed is  $200$  rpm for the position shown. Find the acceleration of  $G$  and angular acceleration of link  $AB$  using kien's construction method.

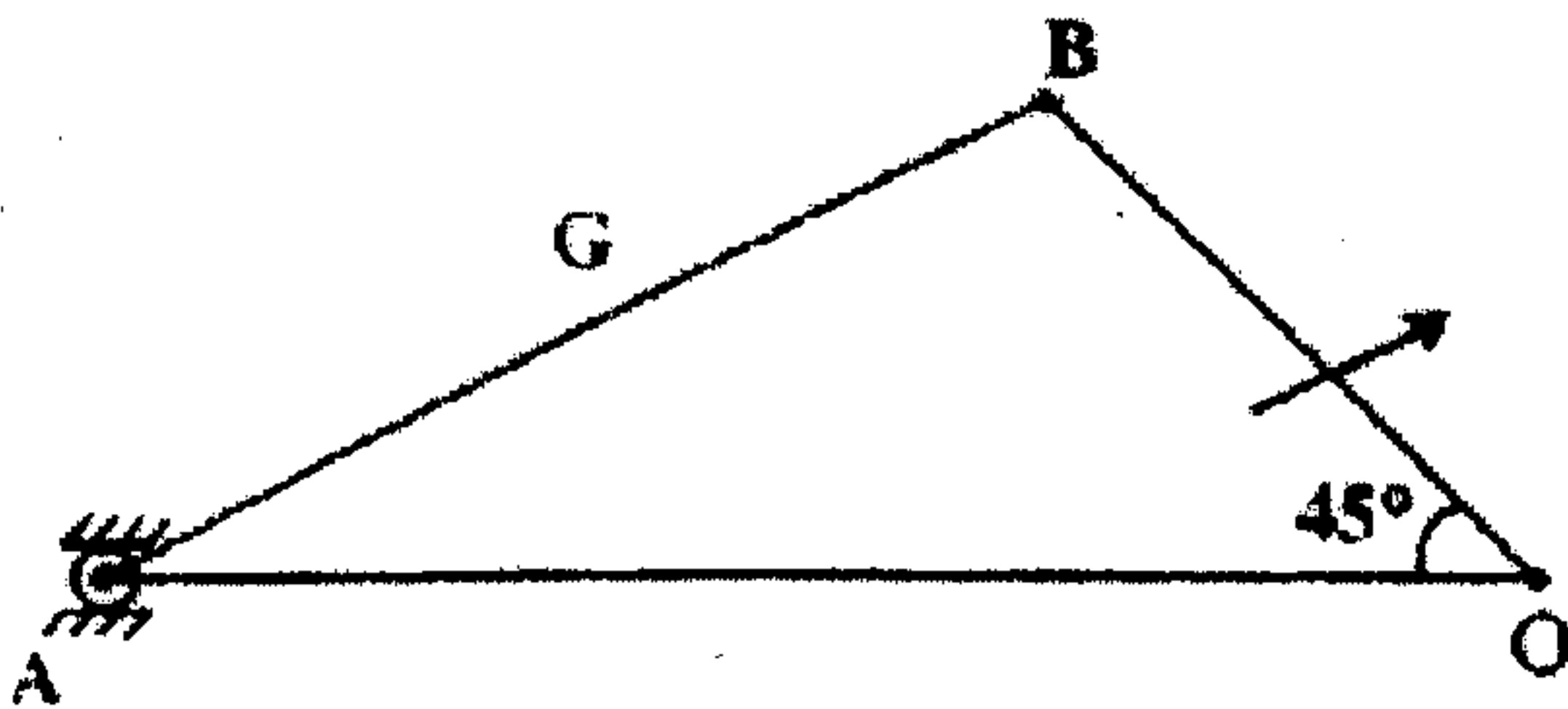


Figure 3

### Module – III

15. A cam with  $30$  mm minimum radius is rotating clockwise at  $1200$  rpm to give the follower motion to a roller follower of  $20$  mm diameter.
- i) Lift =  $25$  mm
  - ii) Follower rises during  $120^\circ$  cam rotation with simple harmonic motion
  - iii) Follower to dwell for  $60^\circ$  cam rotation
  - iv) Follower to return during  $90^\circ$  cam rotation with uniform acceleration and deceleration
  - v) Follower to dwell for remaining period.

Draw the profile of the cam and determine the maximum velocity and acceleration during rise and return stroke.

OR

16. a) What do you understand by 'Gear Train' ? Discuss the various types of gear trains. 12
- b) State and prove the law of gearing. 8

**Module – IV**

17. a) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 rpm. Determine the outer and inner radii of frictional surface, if the coefficient of friction is 0.25, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 MPa. Also determine the axial thrust to be provided by the springs. Assume uniform wear condition. **12**
- b) Derive the relation for the friction torque for self-expanding shoe brake. **8**

OR

18. a) Derive the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension. **8**
- b) A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 kW through belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt if it is a cross drive. Take  $\mu = 0.3$ . **12**
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