Exam No: _____

# GANPAT UNIVERSITY

## M.TECH SEM- I (MECHANICAL ENGG - CAD CAM)

## CBCS REGULAR EXAMINATION – NOV/DEC - 2017

## 3ME113 : ADVANCED KINEMATICS & DYNAMICS OF MACHINES

**TIME: 3 HRS** **TOTAL MARKS: 60**

**Instructions:** (1) This question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

## SECTION: I

**Q.1**

**(A)** What is significance of degree of freedom of kinematic chain? "Even number of DOF required odd number of link & odd number of DOF required even number of link" justify the statement. **(05)**

**(B)** What do you mean by inversion of mechanism? Sketch slider crank chain and its various inversions, stating actual machines in which these are used in practice. **(05)**

**OR**

**Q.1**

**(A)** What do you understand by constrain motion? What are the different types of constrained motion? Explain each type with examples. **(05)**

**(B)** Explain Grubler's criterion for determining degree of freedom. Using Grubler's criterion for planer mechanism, prove that the minimum number of binary link in constrain mechanism with simple hinges is four. **(05)**

**Q.2** In figure 2.1, speed of the crack OA is 600 rpm. Determine the linear velocity of slider D and the angular velocity of the link BD, when the crack is inclined at an angle of 75° to the vertical. The dimensions of various links are: OA=28 mm; AB=44 mm; BC=49 mm and BD=46mm. The center distance between the center of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along horizontal path and OC is vertical. **(10)**

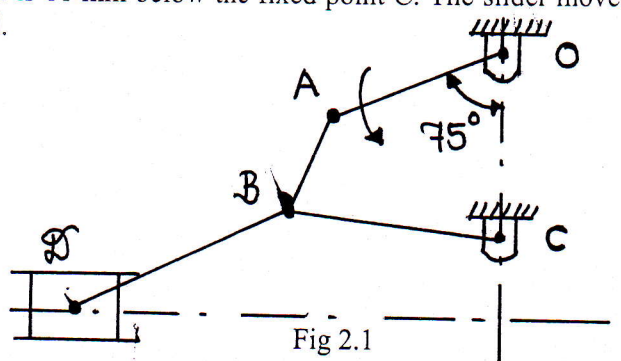


Fig 2.1

**OR**

**Q.2** The dimensions of the four bar chain mechanism are as follow: crank $O_1A$=300 mm $O_2B$=360 mm AB=450 mm and $O_1O_2$= 600mm. The angle $AO_1O_2$= 50°. The crank $O_1A$ rotate an angular velocity of 10 rad/sec and an angular acceleration of 20 rad/sec$^2$ both counter clockwise. Determine the angular velocities and angular acceleration of $O_2B$. **(10)**

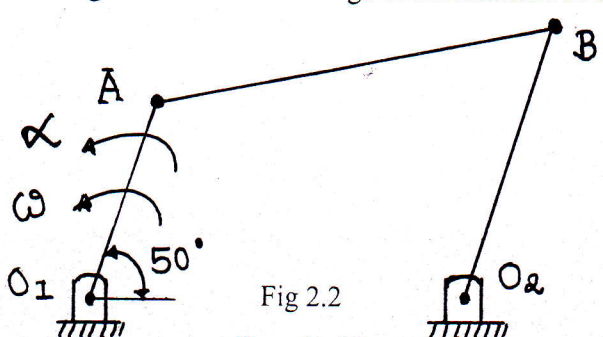


Fig 2.2

**Q.3 Attempt any TWO.** (10)

**(A)** What do you mean by synthesis of mechanism? Find out types of joint required for producing 2 Degree of freedom for number of link 3.

**(B)** What do you understand by kinematics Pair? Explain different type of kinematic pair with example.

**(C)** Explain characteristics of coordinate coupling.

## SECTION: II

**Q.4** Determine velocity of the point B on link 3 of the mechanism shown in figure 4.1 if the crank 2 is driven at an angular velocity $\omega_2$ 48 rad/sec CCW. What is the angular velocity of link 3? Take $AO_2$ =200 mm AB = 400 mm $BO_4$ = 275 mm $O_2O_4$ = 350 mm and angle $BO_4O_2 = 90^0$ $\omega 2=115^0$. Use kinematic coefficient method. (10)

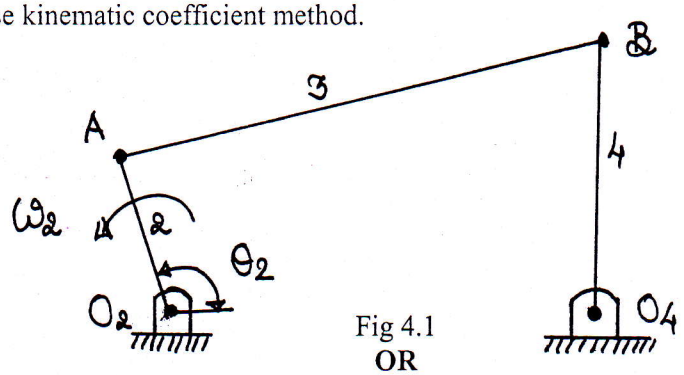


Fig 4.1

**OR**

**Q.4** Develop an equation for the relationship between the angular velocity of the input and output crank of the four bar linkages shown in figure 4.2.Use complex algebra method (10)

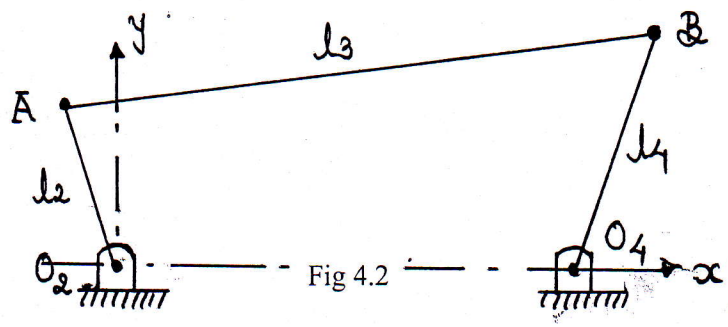


Fig 4.2

**Q.5**

**(A)** The link 1 of the four bar mechanism is fixed link, link 2 is a crank, link 3 is a coupler and link 4 is a follower link. The lengths of links are as follows: Link 1=4units, Link2=5 units Link 3=2 units and link 4=5 units and input angle is 80°. Find (05)

i. All possible solution for angle Θ3 and Θ4.

ii. Transmission angle

iii. Minimum and maximum value of transmission angle.

**(B)** The driving moment applied on link is shown in figure 5.1. Determine the force $F_4$ necessary to be applied on link 4 for equilibrium. Also Determine the state of loading of the connecting rod. (05)

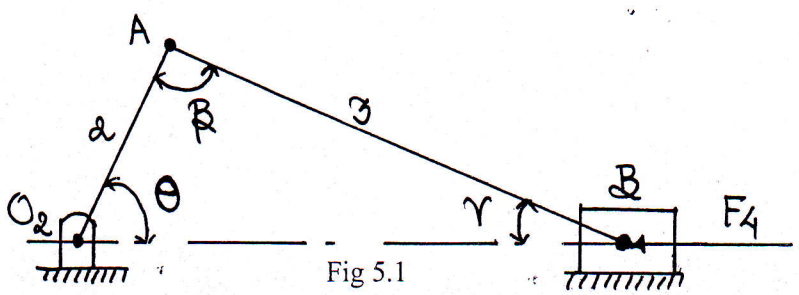


Fig 5.1

**OR**

**Q.5** Make a complete inertia force analysis of the four bar chain mechanism (Refer Figure 2.2) with following data: Mass of 2nd, 3rd and 4th links are 2 kg, 4 kg and 6 kg respectively.G2, G3 and G4 are at mid points. Moment of inertia of link 2nd, 3rd and 4th are 225 kg/mm$^2$, 120 kg/mm$^2$ and 220 kg/mm$^2$. **(10)**

**Q.6 Attempt Any TWO.** **(10)**

**(A)** Explain necessary condition of Grashof's law for four bar chain mechanism.

**(B)** Fig 6.1 shows a weight W = 66.75 N connected a pivoted rod which is assumed to be weightless and very rigid. A spring having a rate of k= 10.68 kN/m is connected to the center of the road of the rod and holds the system in static equilibrium at the position shown. Determine the period of the motion.

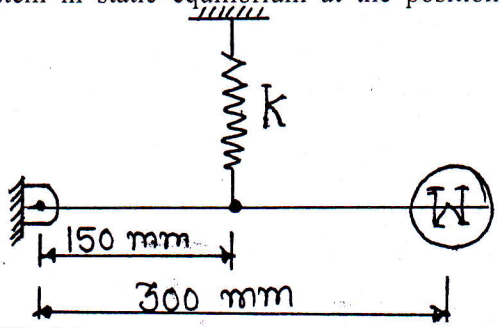


Fig 6.1

**(C)** Explain the resonance condition in vibration analysis.

**----------END OF PAPER----------**