Code No: RR411405 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED KINEMATICS & DYNAMICS
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Find the mobility of the selected mechanisms. shown in figure 1 [16]

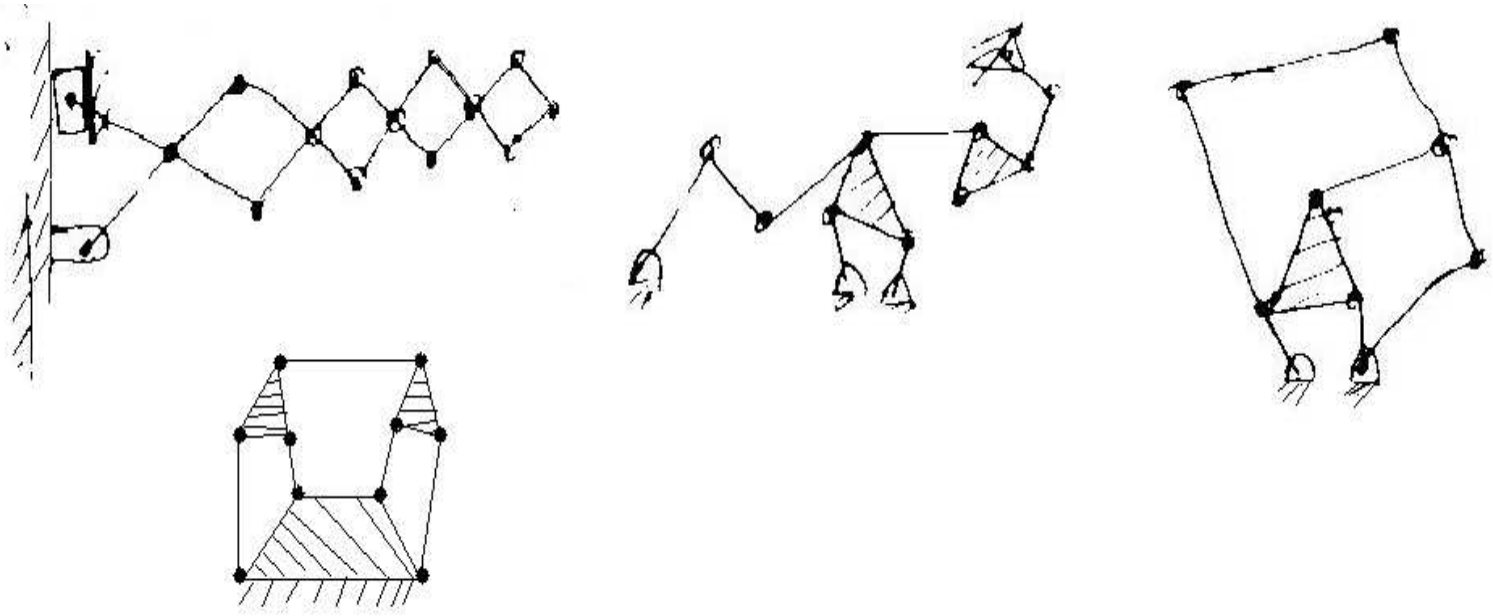

Figure 1:

2. State Goodman's indirect acceleration analysis and explain it in brief with an example. [16]

3. State the Robert's - chebyshev theorem, prove it by considering a four-bar mechanism. [16]

4. (a) Explain the Hartman's construction in detail.
   (b) Explain about the position-analysis problem of Spatial system. [10+6]

5. The driving moment applied on link '2' is as shown in Figure 2 below. Determine the force on link '4' that is necessary to be applied for equilibrium of the linkage. Also determine the state of loading on the connecting rod.
   Given data: O_2.A = 10 cm, A.B = 32 cm. [16]

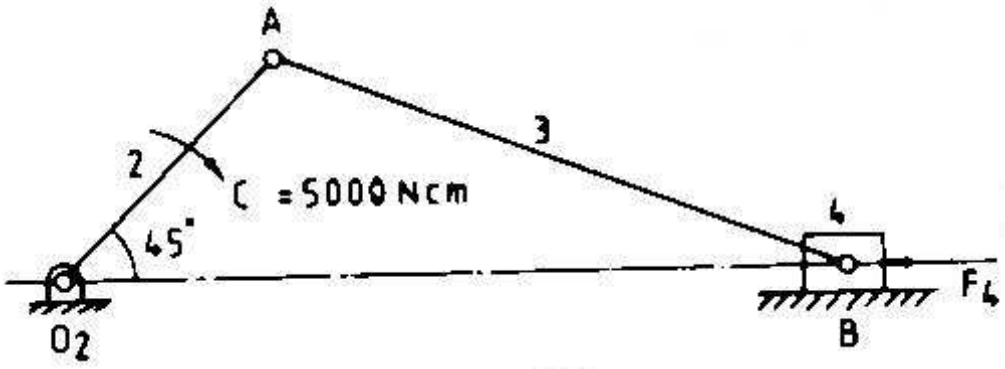

Figure 2:

6. Explain the rate-of-change-of-Energy method in dynamic motion analysis ,for the determination of input acceleration of the mechanism at any instant. [16]

7. (a) Write about chebyshev spacing of precision points.
   (b) What is dwell mechanism? Explain it clearly.
   (c) What are the errors in function generation synthesis problems? [5+6+5]

8. Drive the Freudenstein's equations for the synthesis of slider-crank mechanism. [16]

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Code No: RR411405 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED KINEMATICS & DYNAMICS
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the various inversions of Grashoffs law?
   (b) Derive the minimum numbers of binary links in a constrained mechanism with simple hinges using Grubler's criterion. [8+8]
2. State Hall's and Ault's auxiliary point method of acceleration analysis and explain it in brief with an example. [16]
3. Draw the cognate linkage of any Four-bar mechanism, using Roberts-chebyshev theorem and explain its procedure. [16]
4. Using Hartman's procedure constract the inflection circle for a moving plane shown in Figure 3 below. Assume $\omega_m = 0.5$ rad/s (c.c.w), $O_s \rightarrow$ S = 7 cm, P$\rightarrow$ S = 3 cm, $\theta = 30^0$.

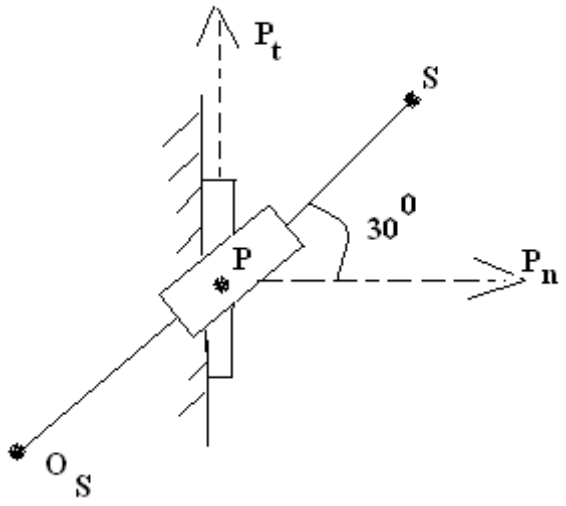

Figure 3:

5. Determine the driving torque available on crank '2', if a force 2000 N is applied on link '4' as shown in Figure 4 below. Also, determine the bearing loads.
   Given data: O_2.A = 10 cm, AB = 30 cm. [16]
6. Prove the Quinn's Energy distribution method in Dynamic motion analysis. [16]
7. State the 'two position synthesis of a four-bar mechanism'. Give the step by step procedure to obtain the synthesized four-bar crank-rocker and slider crank mechanisms by using two position synthesis. [16]

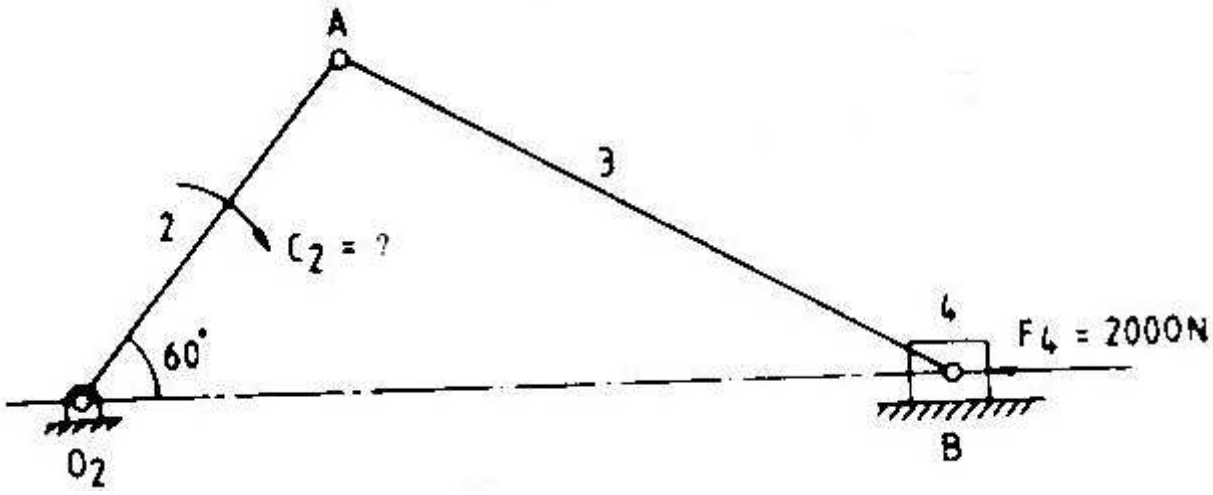

Figure 4:

8. Describe the Bloch's synthesis method for the synthesis of four-bar function generator. [16]

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Code No: RR411405 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED KINEMATICS & DYNAMICS
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Explain how the mobility of a mechanism can be determined using Grubler's criterion. What is the deficiency by this method and explain by which method this deficiency can be overcome? [16]

2. In the mechanism shown in below figure 5. ω_2 = 10 rad/sec (constant) clockwise, O_2A = 80mm, AB = 50mm and BC = 80mm. Determine ω_6 and α_6 by using Goodman's indirect acceleration approach. [16]

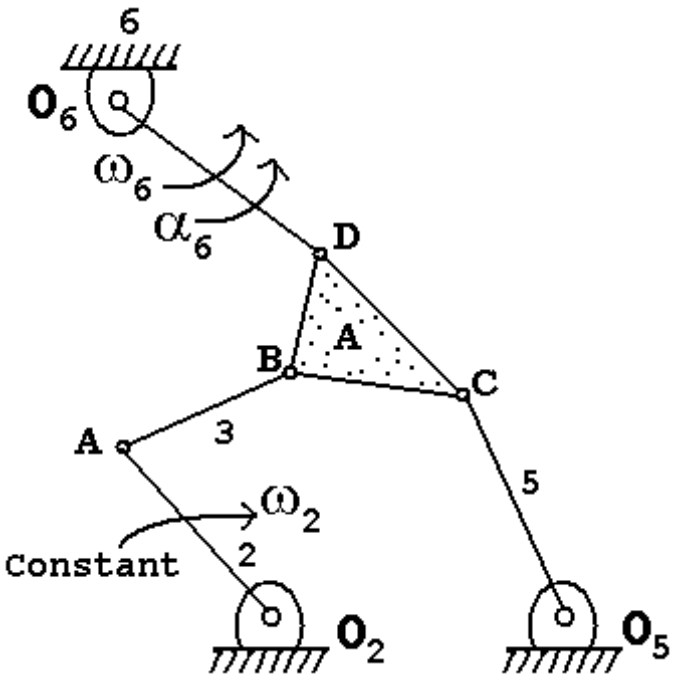

Figure 5:

3. (a) Explain the Bobillier's construction of a Four -bar mechanism.
   (b) What is collineation axis?
   (c) What is Bobiller's theorem? [6+5+5]

4. A four -link RGGR crank-rocker mechanism shown below. The knowns are the position and plane of rotation of the input link, the plane of rotation of the output link, and dimensions of all four links. Find the positions of all moving links when the input crank is set to θ_2 = -45^0 as shown in Figure 6 below. Solve the problem using graphical approach.
   Given data: O^2.A = 2 cm, AB=7 cm, O^4.B = 8 cm. [16]

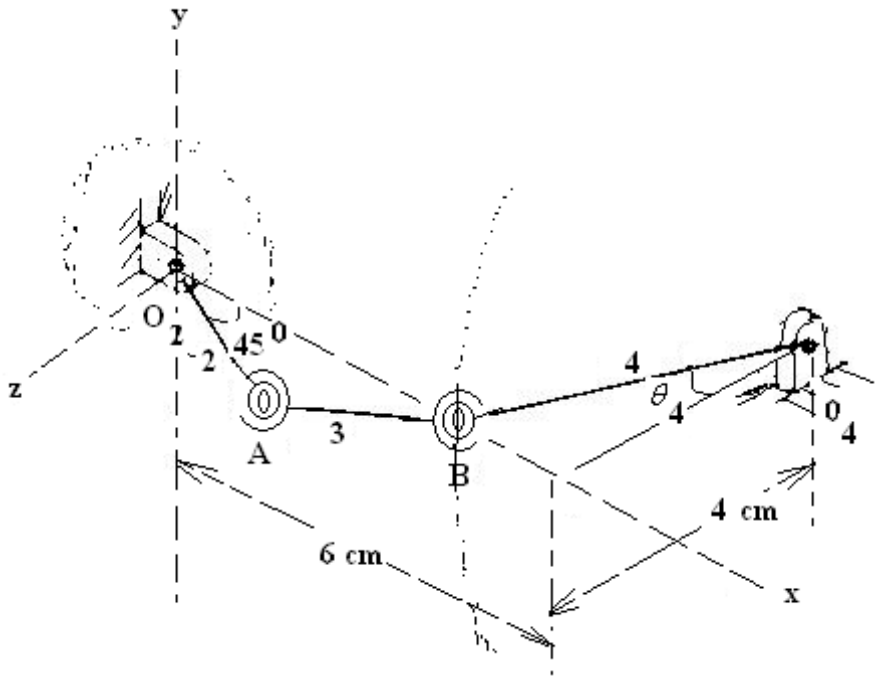

Figure 6:

5. Make a complete inertia force analysis for the reciprocating mechanism shown in figure 7 below, the following data is given. [16]

   Length of crank = 7.5 cm
   Length of connecting rod = 28 cm
   Distance of C.G. of link '2' from main bearing = 5 cm
   Distance of C.G. of link '3' from crank pin = 12 cm
   Crank angle from line of stroke = 600
   Crank speed = 2000 rpm (c.c.w)
   Mass of link '2' = 2.5 kg
   Mass of link '3' = 4 kg
   Mass of link '4' = 3 kg
   Mass moment of inertia of link '2' = 60 kg-cm^2
   Mass moment of inertia of link '3' = 500 kg-cm^2

6. Explain Equivalent-mass-and force method in Dynamic motion analysis, for the determination of input acceleration of the mechanism at any instant. [16]

7. (a) Explain in detail to synthesize a four-bar mechanism by 'overlay method'.
   (b) Write step by step procedure to obtain the synthesized four-bar crank - rocker mechanism using two position pole technique. [8+8]

8. Synthesize a slider crank mechanism so that the displacement of the slider is proportional to the square of the crank rotation in the interval $45^0 \leq \theta \leq 135^0$. use

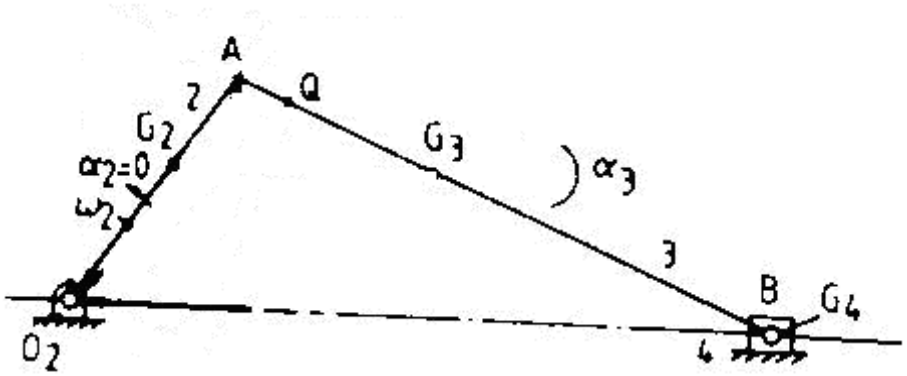

Figure 7:

three precision points with chebyshev spacing. [16]

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Code No: RR411405 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED KINEMATICS & DYNAMICS
(Mechatronics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the three different kinds of mechanisms that can be obtained from a mobility of four bar linkage based on Grashoff's criterion. [16]

2. (a) Write about complex mechanisms and give example.
   (b) Write the applications of Goodman's method to the analysis of low and high -complexity mechanisms.
   (c) Write about sign conventions of Goodman's approach. [5+5+6]

3. Find the inflection circle for the motion of the coupler of the slider-crank linkage shown in Figure 8 below and determine the instantaneous radius of curvature of the path of the coupler point 'C'. Data is given below O_A.A = 2 cm , AB = 2.5 cm, AD = DB, DC = 1 cm & AB perpendicular to DC. [16]

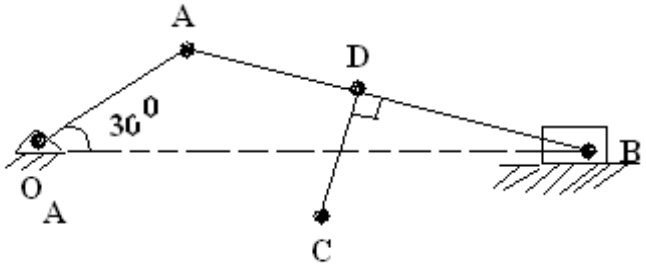

Figure 8:

4. A four -link RGGR crank-rocker mechanism shown below. The knowns are the position and plane of rotation of the input link, the plane of rotation of the output link, and dimensions of all four links. Find the positions of all moving links when the input crank is set to θ_2 = -45^0 as shown in Figure 9 below. Solve the problem using Analytical approach.
   Given data: O_2.A = 1 cm, AB = 3.5 cm O_4.B = 4 cm

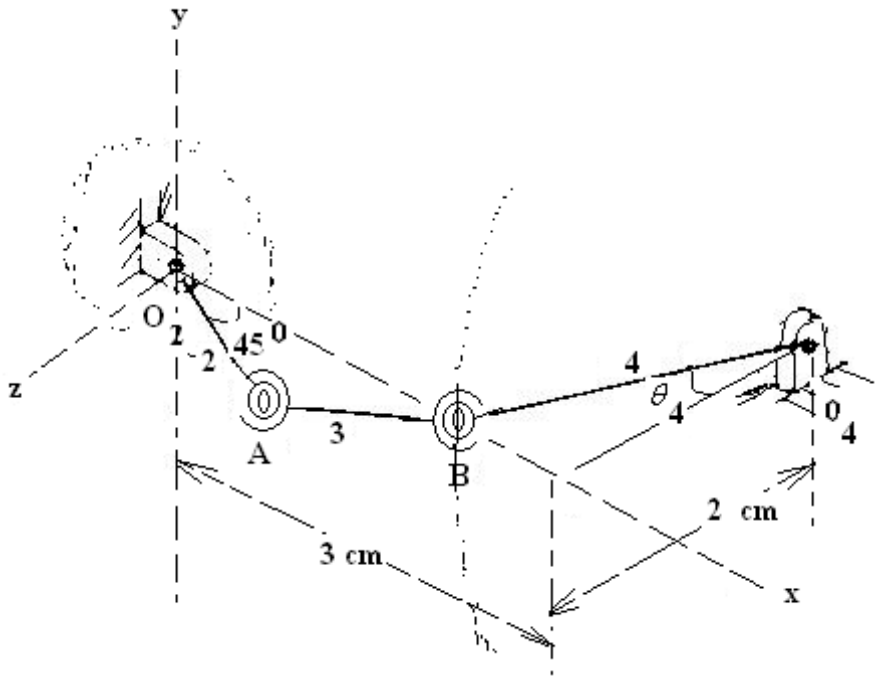

Figure 9:

5. Make a complete inertia force analysis for the four-bar mechanism shown in figure 10 below, the following data is given. [16]

   Length of input crank = 25 cm
   Length of connecting rod = 30 cm
   Length of output crank = 30 cm
   Base link length = 50 cm
   Center of gravity of all links located at their mid points
   Crank angle = 60^0
   Crank speed = 2500 rpm (c.c.w)
   Angular acceleration of crank = 0
   Mass of link '2' = 2.5 kg
   Mass of link '3' = 1 kg
   Mass of link '4' = 2.5 kg
   Mass moment of inertia of link '2' = 225 kg-cm^2
   Mass moment of inertia of link '3' = 120 kg-cm^2
   Mass moment of inertia of link '4' = 225 kg-cm^2

6. Define Energy contribution coefficient. Describe the Quinn's Energy distribution method for the direct determination of input velocity of the mechanism at any instant. [16]

7. Derive the expressions for the optimization of transmission angles for a crank-rocker mechanism and a slider - crank mechanism. [16]

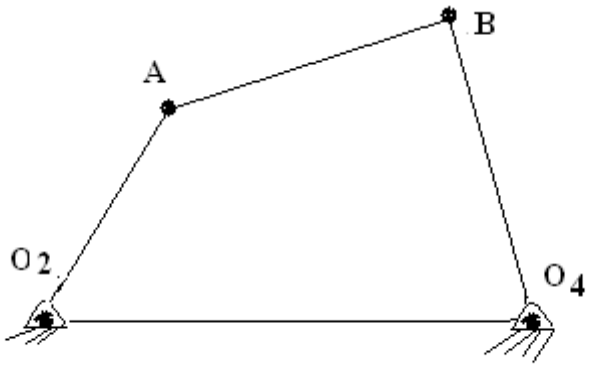

Figure 10:

8. What is Freudensteins equation? Describe the use of Freudensteins method for synthesis of Four-bar crank-rocker mechanism. [16]

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