Code No: NR411405 **NR**

IV B.Tech I Semester Supplementary Examinations, April/May 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) Write Kutzbach criterion for the nobility of a planar mechanism. Apply the criterion for planar mechanisms with binary links and revolute joints as given below and find the mobility in each case.
   i. 3 links and 3 joints
   ii. 4 links and 4 joints
   iii. 5 links and 5 joints.

   (b) For a four bar linkage the following data are given
   $O_2A = \overline{r_2} = -0.354\widehat{i} + 0.354\widehat{j} cm$
   $AB = \overline{r_3} = 1.385\widehat{i} + 0.571\widehat{j} cm$
   $O_4B = \overline{r_4} = 0.368\widehat{i} + 0.931\widehat{j} cm$
   $\overline{w_2} = 200\widehat{k}\ rad/\sec, \overline{w_3} = 85.3\widehat{k}\, rad/\sec\ and\ \overline{w_4} = 129\widehat{k}\ rad/\sec$. $O_2O_4$is the fixed link.
   If $\overline{\alpha_2} = 0$, determine analytically the accelerations.

2. Derive Euler-savary equation and state the uses of this equation.

3. In a Fone-link RGGR (Revolute Globular Globuler Revolute) linkage the following data is given,

$$\overline{R_{O_4O_2}} = 12\widehat{i} + 3\widehat{k}\, cm$$
$$\overline{R_{Ao_2}} = 2\widehat{i} + 3.46\widehat{j}\, cm$$
$$\overline{R_{BA}} = 10\widehat{i} + 2.71\widehat{j} + 10.89\widehat{k}\, cm$$
$$\overline{R_{Bo_4}} = 6.17\widehat{i} + 7.89\widehat{k}\, cm$$
$$\overline{w_2} = \overline{w_{o_2A}} = 40\widehat{k}\, rad/\sec$$

$\overline{\alpha_2} = 0,\ O_2O_4\, is\, the\, fixed\, link$
$Find\, \overline{w_{BA}},\ \overline{w_{BO_4}}\ and\ \overline{V_B}$

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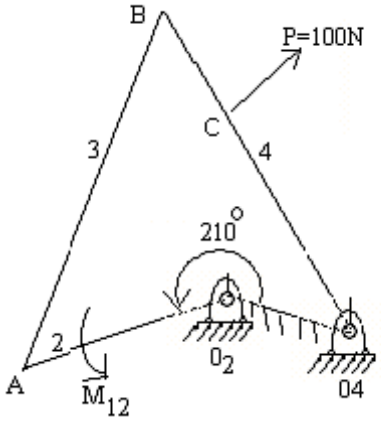
Find $\overline{w_{BA}}, \overline{w_{Bo_4}}\ and\ \overline{V_B}$.

4. Synthesize a four-bar function generator to solve the equation $y = x^{1.4}, 1 \leq x \leq 5$ Using chelyshev spacing for three precision points. Take initial angle of crank $\phi_0 = 30^0$, initial angle of rocker $\psi_0 = 60^0$. Range of crank and rocker angles = 90^0.

5. Find the frame reactions and torque M_{12} necessary to maintain equilibrium of the four bar planar linkage shown in figure2.



R_{Ao_2} = 3.5cm

R_{BA} = R_{Bo_4}=6cm

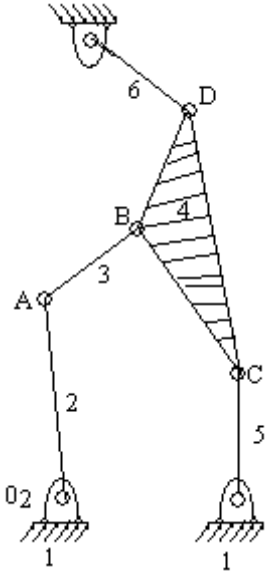
R_{Co_4} = 4cm

$R_{o_2o_4}$ = 2cm

6. (a) In the mechanism shown in figure1, $w_2 = 10\,rad/s(cw)$(constant). Determine w_6 using Auxiliary-point method. Given O_2A=7.5cm, AB=5cm, BC=7.5cm

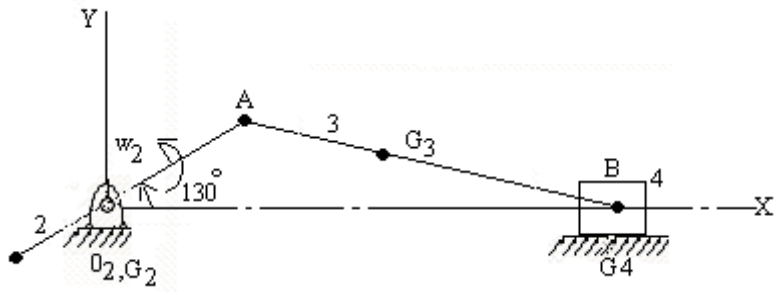
$$O_5C = 6.25cm\,(and\,is\,vertical),\ CD = 10cm,\ BD = 5cm,\ O_6D = 5cm$$

$$\underline{|O_2AB}\ = 110^0,\ \underline{|ABC}\ = 115^0,\ \underline{|O_6DB}\ = 117^0$$



(b) State Roberts-Chebychev theorem and explain what is meant by cognate linkages.

7. In the slider crank mechanism shown in figure, find the external torque to be applied to the crank.



$R_{Ao_2} = 3cm\,, \quad R_{BA} = 12cm, \quad R_{G_3A} = 5cm, \quad m_3 = 2kg, \quad I_{G_3} = 0.3kg.cm.\sec^2$

$\alpha_2 = 0, \quad \overline{\alpha_3} = 7000\widehat{k}\, rad/\sec^2, \quad \overline{A_{G_3}} = -7000\widehat{i} - 4000\widehat{j}\, cm/\sec^2$

Neglect inertia of crank and slider.

8. Write short notes on the following:
   (a) Grashoffs law
   (b) Equivalent mass and force method.
   (c) Overlay method
   (d) Errors in function generation synthesis of mechanism.

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