MENOUFIA UNIVERSITY
FACULTY OF ENGINEERING
SHEBIN ELKOM
First SEMESTER EXAMINATION
ACADEMIC YEAR:- 2017/2018

DEPARTMENT:PROD.ENG.&MECH.DESIGN
POST GRADUATE MASTER LEVEL 600
SUBJECT/CODE:MECHANISMS/ PRE615
TIME ALLOWED: 3 HOURS
DATE:- 26/5/2018

This exam measures the following iLOs(a_4,a_{13},a_{19},b_2,b_{17},c_7)

ANSWER THE FOLLOWING QUESTIONS :- (100 MARKS) MARKS

Question No. 1 :- (25)

In the mechanism shown in Fig. 1, using the position analysis of loop closure equations to drive the following as fuctions of θ_2 :-

1 -The position angles of link 3, $\theta_3=f(\theta_2)$, and link 4, $\theta_4=f(\theta_2)$,

2 –The position angle of link 5, $\theta_5=f(\theta_2)$ and also, the vertical position of slider C, $Y_c=f(\theta_2)$.

2 -The angular velocities of link 3, $\omega_3=f(\theta_2)$ and link 4, $\omega_4=f(\theta_2)$.

3 -The angular acceleration of link 4, $\alpha_4=f(\theta_2)$.

Question No. 2 :- (25)

Consider the mechanism shown in Fig. 2, crank 2 (O_2A) rotates at a constant agular velocity ω_2 =18 rad/s ,in clockwise direction. Determine the velocity and acceleration of point B by using method of vector mathematics analysis. Also, find the accelerations of points of mass center for link 3 (the point g_3) and link 4 (the point g_4). Select coordinate axes as shown with point (O_2) as the origin of the fixed axis XY-system and the point A as the origin of the moving axis xy-system .

Given:- O_2A= 6 cm, AB= 13 cm, O_4B=4 cm, O_2O_4=16 cm, A g_3=B g_3= 7 cm, O_4 g_4=B g_4= 2.5 cm.

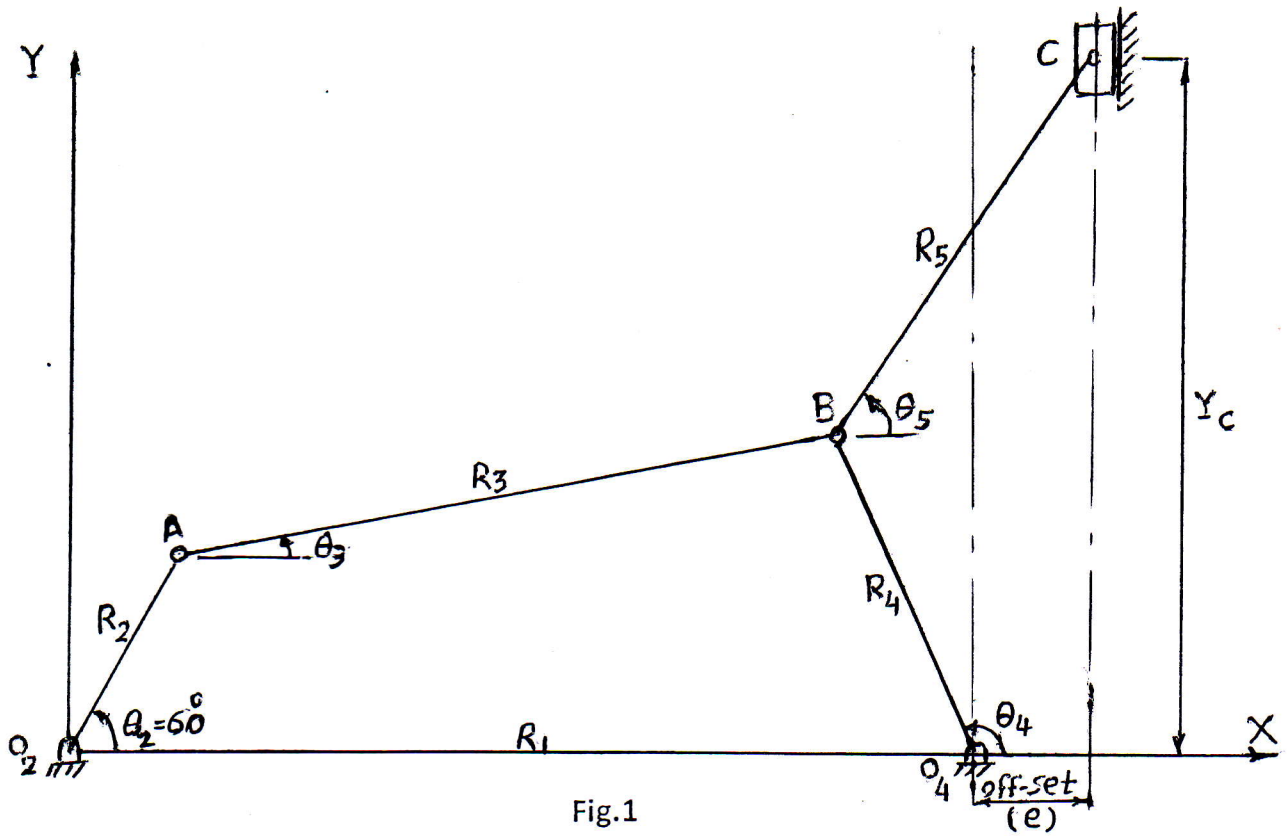

Fig.1

Please see page no. 2

Question No. 3 :- (25)

Fig. 2 is shown the mechanism of problem 2, for which the velocity and acceleration analysis has been made. The masses of links m_2 = 2 kg, m_3 = 10 kg, m_4 = 8 kg, and mass moment of inertia for the links I_{g3}= 0.012 kg.m^2, I_{g4} = 0.008 kg.m^2, where g_3 and g_4 are centers of gravity of the links 3 and 4 respectively. Assume the inertia caused by link 2 (O_2 A) is very small and can be neglected. Considering the effect of the inertia forces only, determine the bearing forces on points O_2 , O_4 and the torque T at point O_2 by superposition method using unit vectors to maintain the mechanism in equilibrium .

Question No. 4 :- (25)

A spring -loaded governor, Fig.3, has the balls attached to the vertical arms of bell-crank levers. The horizontal arms of which lift the sleeve S against the force exerted by a spring. The mass of each ball is 2 kg , the lengths of the vertical and horizontal arms of the bell-crank levers are a= 16 cm and b= 12 cm respectively. The extreme radii of rotation of the balls are 10 cm and 14 cm. The governor sleeve begins to lift at speed to 250 rpm and reaches its highest position with increase of speed to 270 rpm. Determine the required stiffness of the spring and the average force exerted at the sleeve for an increase of the speed 2% above that corresponding to a radius of rotation of 12 cm.

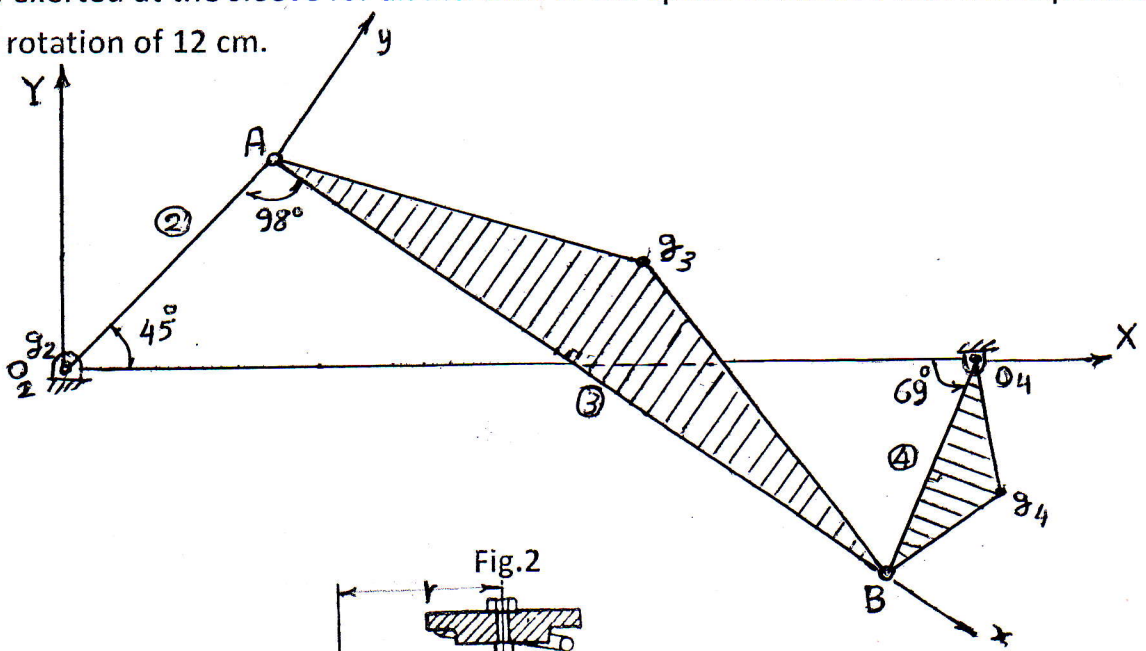

Fig.2

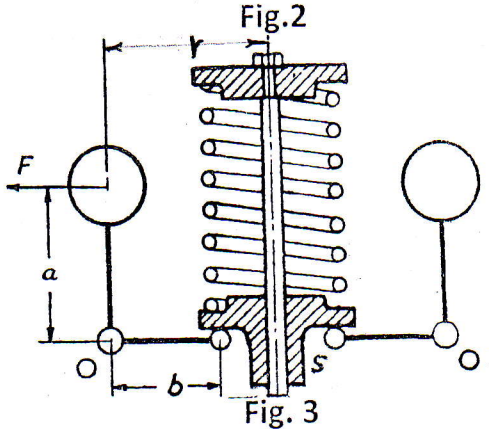

Fig. 3

GOOD LUCK

With our best wishes.

Dr.R. Aouelnasr

This exam measures the following ILOs			
Question Number			
Skills	Knowledge &Understanding Skills	Intellectual Skills	Professional Skills