

Notes: Answer all equations.

Q1: A mechanical arrangement as shown in figure (1). Show which is kinematic chain or not and why?. And find its number of degrees of freedom.

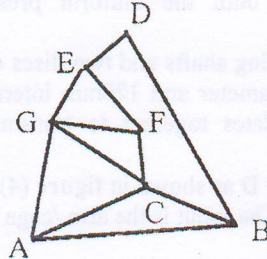


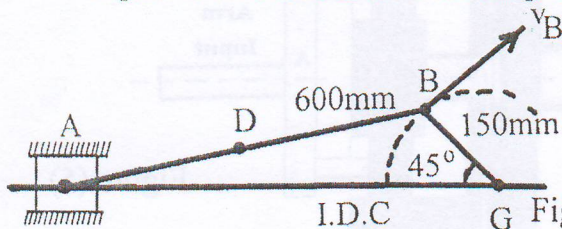
Figure (1)

(20 marks)

Q2: (Answer A or B)

A- The crank of a slider crank mechanism as shown in figure (2A) rotates clockwise of at constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine:

- 1- linear velocity and acceleration of the midpoint of the connecting rod.
- 2- Angular velocity and angular acceleration of the connecting rod in at crank angle of 45° from dead centre position



I.D.C G Figure (2A)

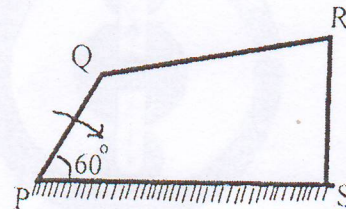


Figure (2B)

B- PQRS is a four bar chain shown in figure (2B) with link PS fixed. The length of links are PQ=62.5mm, QR=175mm, RS=112.5mm and PS=200mm. The crank PQ rotates at 10 rad/sec clockwise. Draw the velocity and acceleration diagram when angle QPS=60° and Q and R lie on the same side of PS. Find the angular velocity and acceleration of links QR and RS.

(10 mark)

Q3: A pulley system use 6 belts each of c.s.a. 800mm² and density 1300 kg/m³. The angle of Lap is 128° on the smaller wheel. The coefficient of friction is 0.3. The maximum force allowed in the belt is 600N. Calculate

- a- The speed at which max power occurs.
- b- The maximum power transmittable by varying the speed.
- c- Calculate the initial belt tension.

(20 mark)

Q4: A compressor has three in line pistons of mass 0.3 kg with a crank radius of 40mm and ratio n of 3. The cranks are equally spaced in angle and positioned as shown in figure (3). Determine the primary and secondary force and turning moment about the reference plane X when it revolves at

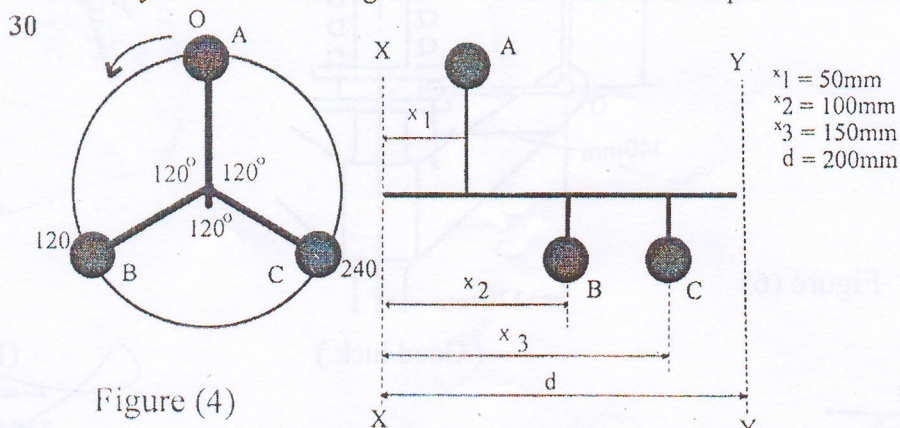


Figure (4)

(Note: use polygon process)

(20 marks)