TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

(BSME) Y4-S1

EMG 2404: MECHANICS OF MACHINES III

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: MAY 2016

TIME: 2 HOURS

INSTRUCTIONS:

- You should have; Answer booklet,; Drawing instruments and Scientific calculator
- This paper consists of FIVE questions
- Attempt any THREE questions.

This paper consists of THREE printed pages

QUESTION 1 Fig. Q1, shows a link mechanism, driven by crank OA, as shown. The link dimensions are as indicated. For the configuration given and with crank angular velocity 20 RPM, determine:

a) Velocity of sliding of B and D
b) Angular velocity of C D
c) Linear acceleration of D
d) Angular acceleration of CD(20 marks)

QUESTION 2 If a Hooke's joint connects two shafts whose axes are inclined to each other by an acute angle ψ, show that the instantaneous speed ratio between these shafts is given by the expression :

$\mathrm{Sec}^2\text{Ø}/(\sec^2\xi.\cos\psi)$ where Ø and ξ are the angles through which the two halves of the joint have turned respectively from a datum. Determine the maximum and minimum values of this ratio when $\psi=16.5^o$.[Derive any formulae used]. *(20 marks)*

QUESTION3 In the mechanism shown in Figure Q3, the crank OA rotates anticlockwise at 240 RPM and moves the sliding blocks C and D, as shown. OA=0.2m, AB= 0.5m, AC= 0.75m, BD=1.25m. For the position shown, find the accelerations of C and D. *(20 marks)*

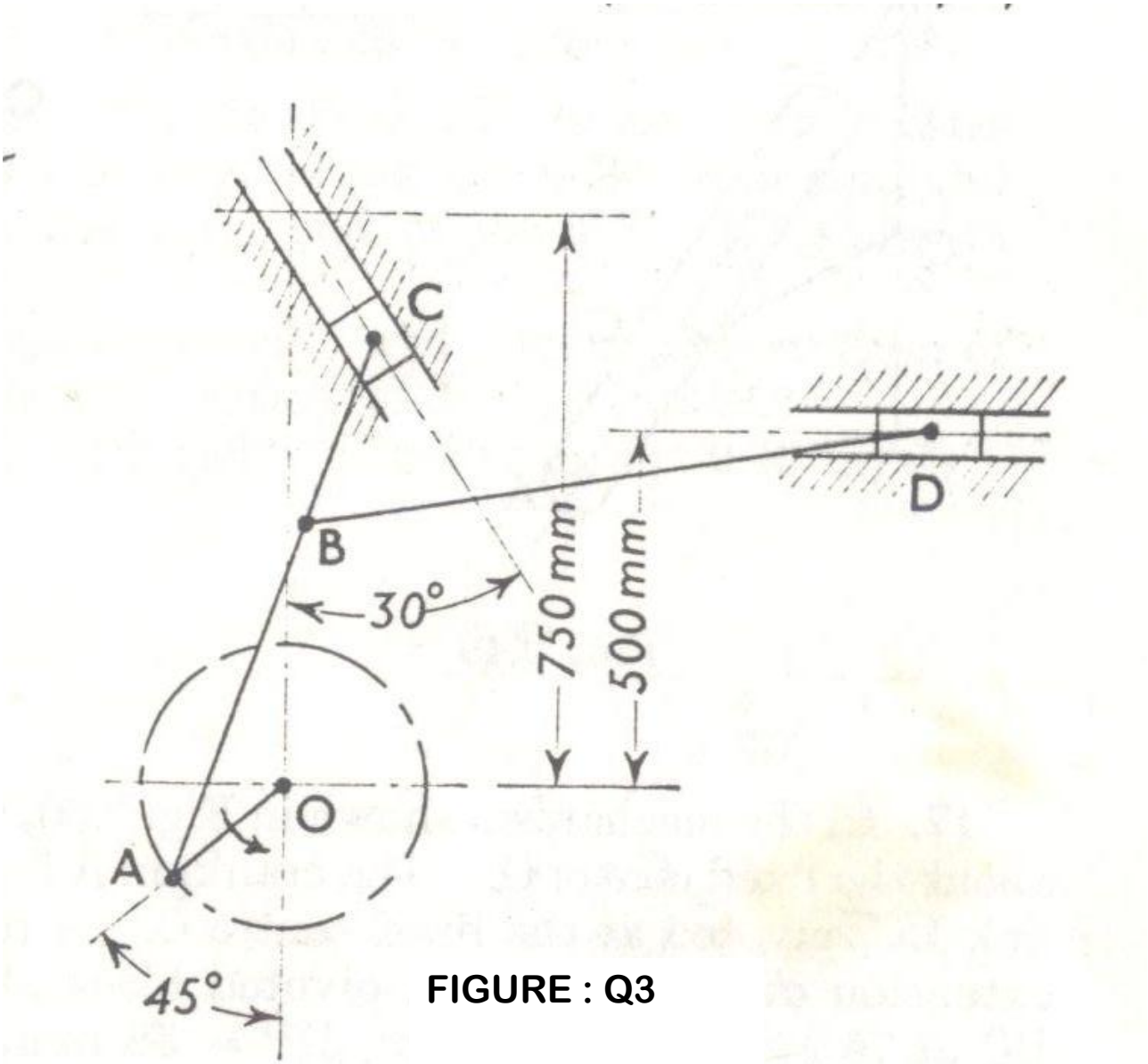

FIGURE : Q3

QUESTION4 The output torque of a multi cylinder engine in Nm is given by

T(Nm)=400+240sin3Θ, where Θ is the angle turned by the crank. Sketch the corresponding curve and determine the variation in the kinetic energy of the flywheel. If the mean speed is 1200 RPM, the total speed variation 20rev/min and the radius of gyration of the flywheel 200mm, find its mass. Calculate also the power developed by the engine. *(20 marks)*

QUESTION5 A straight sided cam has both sides tangential to the base circle which is 25mm radius and the total angle of action is 120°. A lift of 10mm is given to a roller 20mm diameter,

the centre of which moves along a straight line passing through the axis of cam. The camshaft has a speed of 240 rev/min. Determine:

a) The radius of the nose arc;
b) The speed of the roller centre when the roller is in contact with the cam at the end of one of the straight flanks adjacent to the nose;
c) The greatest acceleration of the roller centre (20 marks)

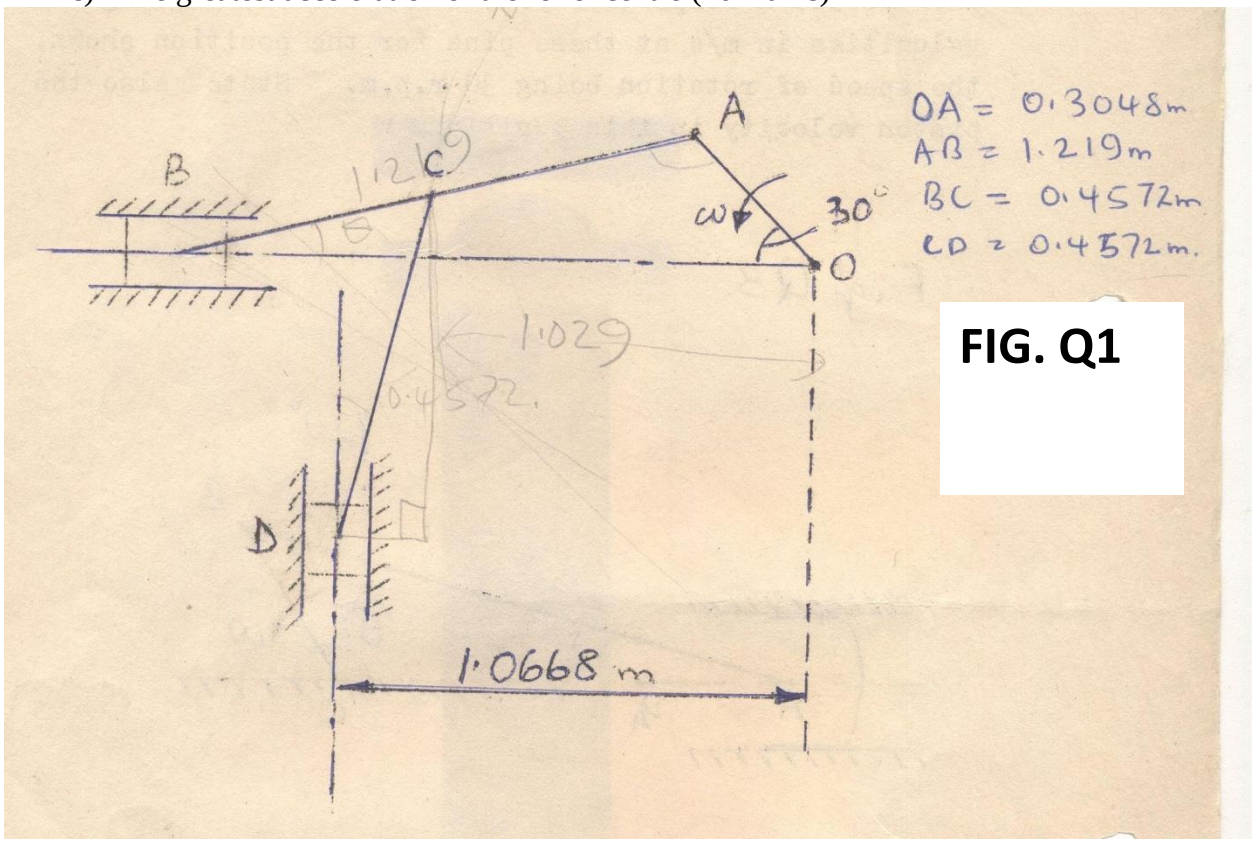

FIG. Q1