

**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**

END OF SEMESTER EXAMINATIONS

SERIES: MAY 2016

TIME: 2 HOURS

**INSTRUCTIONS:**

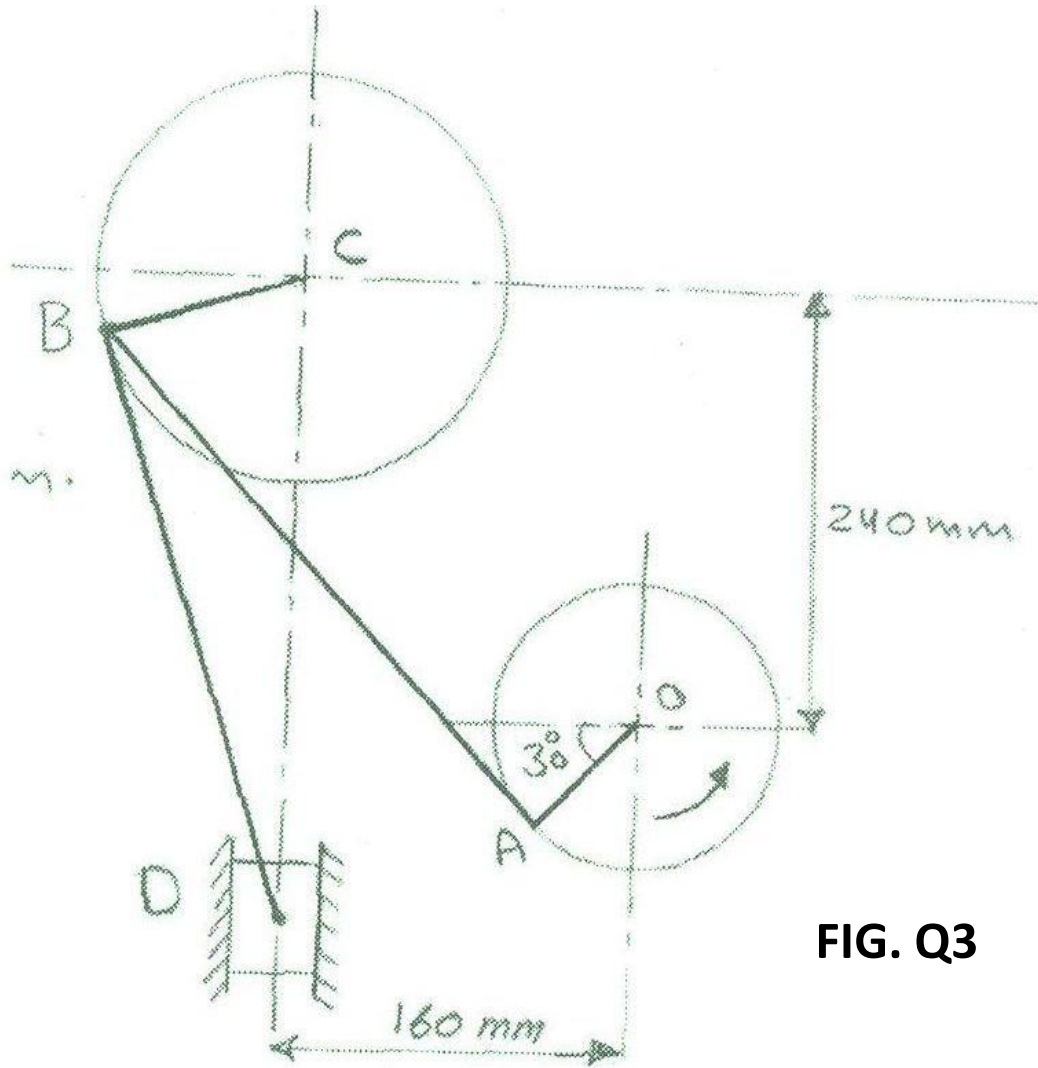
- ❖ You should have; Answer booklet,; Drawing instruments and Scientific calculator
- ❖ This paper consists of FIVE questions
- ❖ Attempt any THREE questions.

**This paper consists of THREE printed pages**

**QUESTION 1** As shown in Fig. Q1, a four-bar chain ABCD drives an arm EF through a slide carried on a swivel at the midpoint of BC. The dimensions are AB=30mm, BC=90mm, CD=60mm and AD=90mm. E lies on the perpendicular bisector of AD at a distance 75mm from AD. If AB rotates clockwise at a constant speed of 10 rad/s, determine the angular acceleration of EF when B, A and D lie on a straight line in the order given. *(20 marks)*

**QUESTION 2** A Hookes joint is to couple two shafts together. The driving shaft rotates at 800r.p.m. Working from first principles determine the greatest permissible angle between the shaft axes so that the speed of the driven shaft is between 775 and 825 r.p.m. What will then be the actual maximum and minimum speeds of the driven shaft? *(20 marks)*

**QUESTION3** Figure below shows the mechanism of a moulding press in which OA=80 mm, AB=320 mm, BC=120 mm, BD=320 mm. The vertical distance of OC is 240 mm and horizontal distance of OD is 160 mm. When the crank OA rotates at 120 r.p.m. anticlockwise, determine: the acceleration of D and angular acceleration of the link BD. *(20 marks)*



**FIG. Q3**

**QUESTION4** The torque exerted on the crankshaft of an engine is given by the equation:

$T(\text{Nm}) = 13500 + 15000\sin 2\theta - 11550\cos 2\theta$ , where  $\theta$  is the crank angle displacement from the inner dead centre. Assuming the resisting torque to be constant, determine:

- The power of the engine when the speed is 125 rev/min.
- The moment of inertia of the flywheel if the speed variation is not to exceed  $\pm 0.4\%$  of the mean speed, and
- The angular acceleration of the flywheel when the crank has turned through  $40^\circ$  from the inner dead centre *(20 marks)*

**QUESTION5** A cam has straight working surfaces which are tangential to the base circle of the cam. The follower is a roller follower with line of stroke passing through the axis of the cam. The particulars are the following:

Base circle diameter ..... = 90mm

Roller diameter.....=40mm  
 The angle between the tangential faces of cam..... =90°  
 The faces are joined by a nose circle of radius.....=5mm  
 R.P.M of cam.....=120

Determine the acceleration of the roller centre:

- (i) when the roller just leaves contact of the flank on its ascent
- (ii) when the roller is at its outer end of its lift (20 marks)

