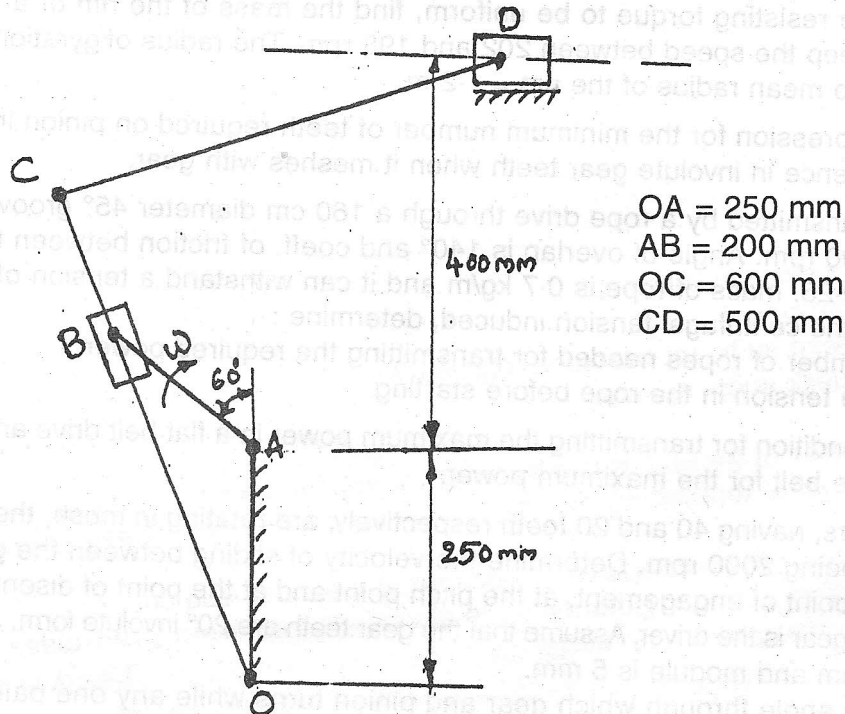
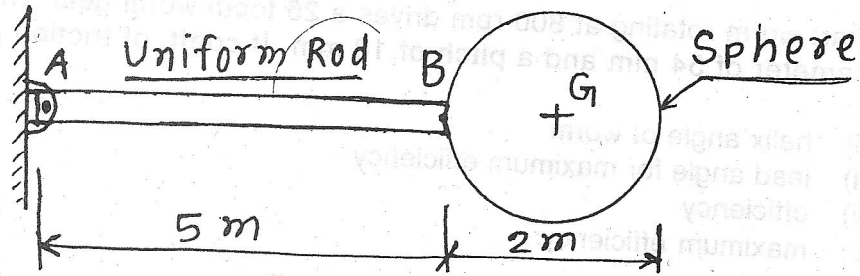


- N.B.:** (1) Question No. 1 is **compulsory**.
 (2) Answer any **four** out of remaining **six** questions.
 (3) Assume any suitable **data** wherever **required**.

1. Explain any **five** in brief with the help of neat sketch :—
- (a) Whitworth quick return mechanism. 4
 - (b) Condition for correct steering 4
 - (c) Peaucellier Mechanism 4
 - (d) Tchebicheff mechanism to trace an approximate straight line. 4
 - (e) Double hook Joint. 4
 - (f) Chordal action of chain. 4
2. (a) For the crank and slotted lever mechanism shown in **Figure** the dimensions of various links are —
- OA = 250 mm
 - AB = 200 mm
 - OC = 600 mm
 - CD = 500 mm
- The crank rotates at 60 rpm.
 Determine the velocity of slider 'D' and angular velocity of link 'CD' by
- (i) Relative Velocity Method 6
 - (ii) I. C. Method. 6
- (b) For the same mechanism, determine the linear acceleration of slider 'D' and angular acceleration of link 'CD' by graphical method. 8



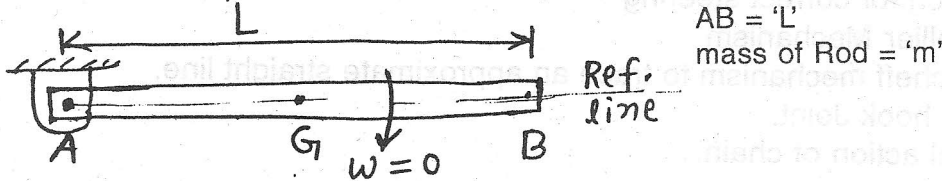
3. (a) A composite system consisting of a rod 'AB' and a sphere with centre 'G' Fixed rigidly to the rod at 'B' as shown in **Figure**. Determine the angular acceleration of the system at the instant when it is released from the horizontal position. Mass of the rod is 20 kg and the mass of the sphere = 5 kg, AB = 5 m and dia. of sphere = 2 m.



TURN OVER

- (b) A vertical double acting steam engine has a cylinder 300 mm dia. and 450 mm stroke and runs at 200 rpm. The reciprocating parts has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/M^2 and below the piston is 1.5 kN/m^2 . Calculate the tangential force on the crank pin and effective turning moment on the crank shaft. **10**

4. (a) A uniform bar of mass 'm' and length 'L' hangs from a frictionless hinge. It is released from the horizontal position as shown in Figure. **10**



Find the angular velocity and linear velocity of the centre of mass 'G', when it is in vertical position ($\theta = 90^\circ$) Solve by work – energy principle.

- (b) The turning moment diagram for a four stroke gas engine may be assumed for simplicity to be represented by four triangles, the areas of which from the line of zero pressure are as follows :
- Suction stroke = $0.45 \times 10^{-3} \text{ m}^2$
 Compression stroke = $1.7 \times 10^{-3} \text{ m}^2$
 Expansion stroke = $6.8 \times 10^{-3} \text{ m}^2$
 Exhaust stroke = $0.65 \times 10^{-3} \text{ m}^2$
- Each m^2 of area represents $3 \times 10^6 \text{ N-m}$ of energy. Assuming the resisting torque to be uniform, find the mass of the rim of a fly wheel required to keep the speed between 202 and 198 rpm. The radius of gyration may be taken equal to mean radius of the rim = 1.2 m. **10**
5. (a) Derive an expression for the minimum number of teeth required on pinion in order to avoid interference in involute gear teeth when it meshes with gear. **10**
- (b) 100 kW is transmitted by a rope drive through a 160 cm diameter 45° grooved pulley running at 200 rpm. Angle of overlap is 140° and coeff. of friction between the pulley and rope is 0.25. mass of rope is 0.7 kg/m and it can withstand a tension of 800 N. Considering the centrifugal tension induced, determine :
- Number of ropes needed for transmitting the required power.
 - The tension in the rope before starting.
6. (a) Derive the condition for transmitting the maximum power in a flat belt drive and find the velocity of the belt for the maximum power. **10**
- (b) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 rpm. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and module is 5 mm. Also find the angle through which gear and pinion turns while any one pairs of teeth are in contact. **10**

