

**5733****December-2008****Kinematics MA – 301****(New Course)**

Time : 3 Hours]
(2 : 30 P.M. to 5 : 30 P.M.)

[Max. Marks : 100

- Instructions :** (1) Attempt both section in separate Answer Sheet
 (2) Figures to the right indicates full marks.
 (3) Use of programable calculator is not permitted.
 (4) Assume suitable data, if required.
 (5) The notation utilised have usual meaning.

SECTION – I

1. (A) Differentiate between crank and slotted lever quick return motion mechanism and witworth quick return motion mechanism. 16
 (B) Define "Machine". Differentiate between a machine and a structure.
 (C) Explain different kinds of kinematic pairs giving example for each one of them.
 (D) Explain the terms
 (a) Inversion
 (b) Incompletely constrained motion.

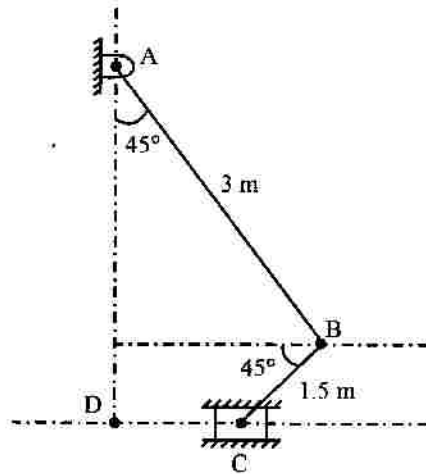
OR

- (A) Derive the equation of Davis Steering gear mechanism.
 (B) Name the different mechanisms which give the approximate straight line motion and explain any one.

2. In the mechanism shown in figure, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2 . 16

The dimensions of various links are $AB = 3 \text{ m}$ inclined at 45° with the vertical and $BC = 1.5 \text{ m}$ inclined at 45° with the horizontal.

- Determine : (a) The magnitude of vertical and horizontal component of the acceleration of the point B and
 (b) the angular acceleration of the links AB and BC.



3. (A) Draw sketches for following : 18
- (i) Cylindrical cam with oscillating roller follower
 - (ii) Cylindrical cam with reciprocating roller follower
 - (iii) Radial cam with radial flat faced follower
 - (iv) Radial cam with offset knife edge follower
- (B) Discuss merits and demerits of knife edge, roller and flat faced followers.
- (C) Draw displacement, velocity and acceleration diagram sketches for uniform velocity motion of a follower. What modifications are necessary to use them in practice ? Discuss.

OR

Draw the cam profile of a radial cam operating a radial roller follower from the following data :

Least radius of cam 50mm

Lift of follower 36mm

Diameter of roller 20 mm

Angle of ascent with uniform acceleration and retardation 120°

Sudden drop of follower immediately after ascent 12mm

Angle of descent with SHM for remaining lift 180°

The cam rotates with uniform speed of 300 rpm.

- Find : (i) Maximum velocity of follower during ascent,
 (ii) Maximum acceleration of follower during descent.

SECTION – II

4. (A) Why is the tension on tight side greater than that on the slack side of the belt to transmit power ? What is the ratio between tensions of tight and slack sides of belt ? 16
- (B) A rope drive is required to transmit power from a shaft rotating at 25 rad/s. on account of surging due to variation in the resisting torque, the maximum permissible load in each rope is : $1250 + (10^5/v^2)$ Newton. Where v = rope speed in m/s (for speeds above 12 m/s)
- The mass of the rope is 1.25 kg/m; the angle of lap is 180° , the total groove angle is 60° , and the co-efficient of friction for rope and pulley is 0.3. Taking into account centripetal tension, determine:
- The linear speed of the rope at which the maximum power per rope is being transmitted when the rope is just on the point of slipping.
 - The necessary effective diameter of the driving pulley measured to the centre of the rope, and the number of ropes required to transmit 96 kW.

OR

- (A) Derive the equation of torque for collar thrust bearing consider
- uniform pressure and
 - uniform wear
- (B) Neglecting collar friction, prove that maximum efficiency of square threaded screw jack, is given by

$$\eta_{\max.} = \frac{1 - \sin \phi}{1 + \sin \phi}$$

- (C) Pitch of the 50 mm diameter threaded screw of a screw jack is 12.5 mm. the coefficient of friction between the screw and the nut is 0.10. Determine the torque required on the screw to raise a load of 25 kN assuming the load to rotate with screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load.
5. (A) Explain the difference between a simple band brake and a differential band brake. What are the advantages of one over other ? 16
- (B) State the condition under which the applied brake force is equal to zero.
- (C) The drum for a band brake of a crane is 300mm diameter, the crane barrel is 350mm diameter, the angle of contact of band brake is 280° and the co-efficient of friction between the band and the drum is 0.25. The brake lever is 600mm long, end of which is fulcrumed. One end of band is pinned at fulcrum while other end is 120mm away from fulcrum. Calculate the force 'F' required to support a load of 10,000 N on the rope round the barrel. Drum rotates in anticlockwise direction.

OR

- (A) What is dynamometer ? Differentiate between absorption and transmission dynamometer.
- (B) Describe the construction and working of a Prony brake dynamometer.
- (C) What is the difference between hydraulically and mechanically operated internal expanding shoe brake ? What are primary and secondary shoes of an internal expanding shoe brake ? Which of the shoes require more braking force ?
6. (A) Explain working of differential gear of an automobile and its calculation. 18
- (B) For steering gear mechanism derive the equation $\tan a = c/2b$
- (C) Differentiate between
- (i) Exact and approximate straight line mechanism.
 - (ii) Ackermann and Davis steering mechanism
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