

Printed Pages—4

EME502

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2102

Roll No.

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B.Tech.

(SEM. V) THEORY EXAMINATION 2011-12

THEORY OF MACHINES—I*Time : 3 Hours**Total Marks : 100***Note :—** (1) Answer **all** the questions.

(2) All questions carry equal marks.

(3) Assume suitable value for missing data if any.

1. Answer any **four** parts : **(5×4=20)**

- (a) Define mechanical advantage and transmission angle of a mechanism.
- (b) Write down a definition of a machine and explain the meaning of the terms which enter into the definition.
- (c) Sketch and describe the four bar chain mechanism. Why it is considered to be the basic chain ?
- (d) What is a Kennedy's Theorem ? Explain with the help of an example and neat diagram.
- (e) How are Whitworth quick return mechanism and crank and slotted-lever mechanism different from each other ?

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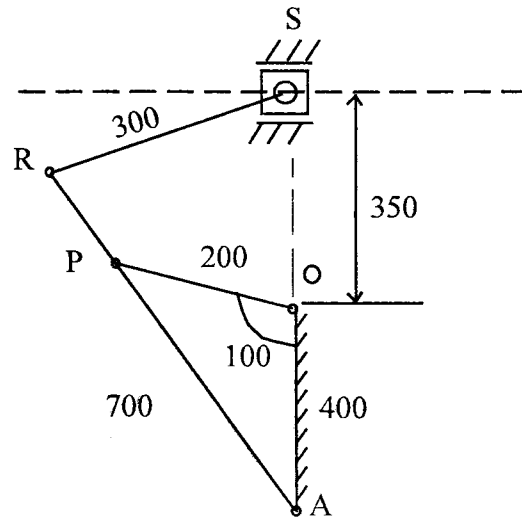
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- (f) What is Complex-Algebra approach for analysing/ solving planer problems ?

2. Answer any **one** part : **(20×1=20)**

- (a) Figure shows the link mechanism of a quick-return mechanism, the various dimensions of which are,
 $OA = 400 \text{ mm}$, $OP = 200 \text{ mm}$, $AR = 700 \text{ mm}$, $RS = 300 \text{ mm}$.
 $\angle AOP = 100^\circ$.

For the configuration shown determine the acceleration of the cutting tool at S and the angular acceleration of the link RS.



- (b) (i) Name different types of *Approximate Straight Line Motion mechanism*. Explain any one of them with neat diagram.
 (ii) Derive an expression for the ratio of angular velocities of the shafts of a Hook's joint.

3. Answer any **two** parts : **(10×2=20)**

- (a) A load of 15kN is raised by means of a screw jack. The mean diameter of the square thread is 42 mm and the pitch is 10 mm. A force of 120 N is applied at the end of a lever to raise the load. Determine the length of the lever to be used and the mechanical advantage obtained. Is the screw self locking ? Take $\mu = 0.15$.
- (b) Derive the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension.
- (c) What is the advantage of self expanding shoe brake ? Derive the relation for the friction torque for such brake.

4. Attempt any **two** parts : **(10×2=20)**

- (a) (i) Compare the performance of Knife edge, roller and mushroom followers.
- (ii) Why is a cycloidal motion programme most suitable for high speed cams ?
- (b) Derive relation for velocity and acceleration for a convex cam with a flat follower.
- (c) Explain the procedure to layout the cam profile for a reciprocating follower.

5. Answer any **two** parts : **(10×2=20)**

- (a) Derive an expression for the minimum no of teeth required on the pinions in order to avoid interference.
- (b) Show that either the cycloidal or the involute shape for the profile of the wheel teeth satisfies the fundamental condition for the transmission of uniform motion. What are the principal advantages of the involute shape over cycloidal shape ?
- (c) An epicyclic gear consists of a pinion, a wheel of 40 teeth and an annulus with 84 internal teeth concentric with wheel. The pinion gears with the wheel and annulus. The arm that carries the axis of the pinion rotates at 100 rpm. If the annulus is fixed, find the speed of the wheel; if the wheel is fixed, find the speed of the annulus.