

3. What are the free body diagrams of a mechanism? Explain the implementation of this concept for a slider-crank mechanism.
4. Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines.
5. A pinion of 20 involute teeth and 12.5 cm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm. What is the least pressure angle which can be used to avoid interference?
6. Discuss the least square technique. How is it useful in designing a four link mechanism when three positions of the input and output link are known?

SECTION-C

7. A single cylinder vertical engine has a bore of 30 cm, a stroke 36 cm and a connecting rod of length 72 cm. The weight of the reciprocating part is 130 kg. When the piston is at quarter stroke from TDC and is moving downwards, the net pressure on it is 0.6 MPa. If the speed of the engine is 250 *r.p.m.*, calculate the turning moment on the crankshaft at the instant corresponding to the position stated above.
8. Two shafts A and B are coaxial. The gear C (50 teeth) is rigidly mounted on shaft A and a Compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. Gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B.
 - a) Sketch the arrangement.
 - b) Find the number of teeth on internal gear G assuming that all gears have the same module.
 - c) If the shaft A rotates at 110 *r.p.m.*, find the speed of shaft B.
9. Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve with neat and clean diagram.

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