RO 8403 Kinematics and Dynamics of Machines

Important 13mark questions

Unit I

1. Derive the expression for velocity and acceleration of the slider of a simple slider crank mechanism.
2. Draw the Displacement, Velocity and Acceleration Diagrams when the Follower Moves with Simple Harmonic Motion and derive the expression for the maximum velocity and acceleration during lift and the return stroke.

Unit II

1. Derive the expression for the maximum teeth required in a spur gear to avoid interference.
2. The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20^0 involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, Find the addendum.

Unit III

1. Derive from first principles an expression for the effort required to raise a load with a screw jack taking friction into considerations.
2. An electric motor driven power screw moves a nut in a horizontal plane against a force of $75\ kN$ at a speed of $300\ mm/min$. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at the screw threads is 0.1. Estimate power of the motor.

Unit IV

1. Write a short note on static force analysis of a slider crank mechanism and derive the expression for (i) piston side thrust, (ii) force along the connecting rod (iii) Tangential force at the crank pin.
2. A petrol engine 90 mm in diameter and 120 mm stroke has a connecting rod of 240 mm length. The piston has a mass of 1 kg and the speed is 1800 r. p. m. On the explosion stroke with the crank at 30^0 from top dead centre, the gas pressure is $0.5\ N/mm^2$. Find
   (i) The resultant load on the gudgeon pin,
   (ii) The thrust on the cylinder walls,
   (iii) The speed, above which other things remaining same, the gudgeon pin load would be reserved in direction. Also calculate the crank effort at the given position of the crank.

Unit V

1. A body vibrating with viscous damping makes 10 complete oscillations per second and in 100 cycles its amplitude diminishes 10%. Calculate the logarithmic decrement, and determine the damping constant n and the damping ratio n/w. In what proportion would the period of vibration be decreased if damping were removed?

2. Derive the expression for the primary and secondary unbalanced forces in a vee engine.