1. Find the input torque required for the static equilibrium of a crank-rocker mechanism when its crank is at 600 and applied force on link CD at point E is 200 N at an angle 2100. Link lenghs: AD (fixed link) =260 mm, AB=100 mm, BC=254 mm CD=240 mm and DE=150 mm

B C

                200N *L*210*0*

T

E

A                                                                        D

1. A vertical double acting steam engine has a cylinder 300 mm diameter 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 1250 from the top dead center, the steam pressure above the piston is 30 KN/m2 and below the piston is 1.5 KN/m2. Calculate the effective turning moment on the shaft.
2. A single cylinder vertical engine has a bore of 305 mm, a stroke of 400 mm and a connecting 800 mm long. When the piston is at quarter stroke and is moving down wards, the net pressure on it is 65 N/m2. The speed of the engine is 250 rpm. The CG of the connecting rod is 500 mm from the small end and the radius of gyration about the centroidal axis is 300 mm. The mass of the reciprocating parts (piston and gudgeon pin) is 90 kg and that of the connecting rod is 120 kg. Determine the turning moment of the crank shaft at that instant.
3. A turbine rotor of a ship is of 2000 kg mass and has a radius of gyration of 0.8 m. Its speed is 2000 rpm. The ship pitches 50 above and below the mean position. A complete oscillation takes place in 20 seconds and the motion is simple harmonic. Determine
4. The maximum couple tending to shear the holding down bolts of the turbine
5. The maximum acceleration o f the ship during pitching
6. The direction in which the bow will tend to turn while rising, if the rotation of the rotor is clock wise, when looking from aft.
7. A trolley car with a total mass of 2700 kg runs on rails 1 m apart with a speed of 30 km/hr. The track is curved with a radius of 40 m toward the right of the driver. The car has four wheels each of diameter 700 mm and the total moment of inertia of each pair of wheels and the axle is 15 kgm2. The car is driven by a motor running in the direction opposite to that of the wheels at a speed five times the speed of rotation of the wheels. The motor and the gear have a moment of inertia 10 kgm2. The rails are at the same level and the height of the CG of the car is 1 m above the rail level. Determine the vertical force exerted by each rail.
8. Derive the expression for angle of heel necessary for the stability of a two wheeler when it takes a turn while moving by considering Gyroscopic and centrifugal effects on the vehicle.