



4. (a) A single dry plate clutch is to be designed to transmit 7.5 kW at 900 r.p.m. Find: 10  
 1. Diameter of the shaft,  
 2. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4,  
 3. Outer and inner radii of the clutch plate, and  
 4. Dimensions of the spring, assuming that the number of springs are 6 and spring index = 6. The allowable shear stress for the spring wire may be taken as 420 MPa.
- (b) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm<sup>2</sup>, find the axial load which the spring can carry and the deflection per active turn 10
5. (a) Design a connecting rod for an I.C. engine running at 1800 r.p.m. and developing a maximum pressure of 3.15 N/mm<sup>2</sup>. The diameter of the piston is 100 mm; mass of the reciprocating parts per cylinder 2.25 kg; length of connecting rod 380 mm; stroke of piston 190 mm and compression ratio 6: 1. Take a factor of safety of 6 for the design. Take length to diameter ratio for big end bearing as 1.3 and small end bearing as 2 and the corresponding bearing pressures as 10 N/mm<sup>2</sup> and 15 N/mm<sup>2</sup>. The density of material of the rod may be taken as 8000 kg/m<sup>3</sup> and the allowable stress in the bolts as 60 N/mm<sup>2</sup> and in cap as 80 N/mm<sup>2</sup>. The rod is to be of I-section for which you can choose your own proportions. Numerator constant may be taken as 320 N/mm<sup>2</sup> and the denominator constant 1/7500. Assume suitable data and state the assumptions you make 10
- (b) Explain the valve gear mechanism for vertical engine with neat labelled diagram. 10
6. (a) Design a rocker arm, and its bearings, tappet, roller for the exhaust valve of a four stroke I.C. engine from the following data: Diameter of the valve head = 80 mm; Lift of the valve = 25 mm; Mass of associated parts with the valve = 0.4 kg ; Angle of action of camshaft = 110° ; R. P. M. of the crankshaft = 1500. From the probable indicator diagram, it has been observed that the greatest back pressure when the exhaust valve opens is 0.4 N/mm<sup>2</sup> and the greatest suction pressure is 0.02 N/mm<sup>2</sup> below atmosphere. The rocker arm is to be of I-section and the effective length of each arm may be taken as 180 mm; the angle between the two arms being 135°. The motion of the valve may be assumed S.H.M., without dwell in fully open position. Choose your own materials and suitable values for the stresses. 15
- (b) What is slip of belt and creep of belt? 5

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