N. B.   1) Question No. 1 is compulsory.

2) Answer any **Four** questions from **remaining six** questions.

3) Assume suitable data wherever required but justify the same.

4) Answer to the questions showed be grouped and written together

Qu. 1 Attempt any five from the following   (20)

a) What do you understand by stress concentration? Elaborate with various cases.

b) Explain the mechanism of fatigue failure.

c) Explain the chordal action in case of chain drive.

d) Theories of elastic failures.

e) Explain effect of keyway on shaft strength give equation for shaft strength factor.

Qu.2 a) Design cotter joint to transmit load of 50 KN which varies from tension to compression, select suitable material factor of safety, Draw sketches of areas involved in various failures. (14)

b) Define FOS suggest various values for different types of load and materials and Explain on which factors FOS selection depends?   (06)

Qu. 3 a) Design flange coupling (Protected type) to transmit 80 KW at 12000rpm. Select suitable material and FOS with justification.   (12)

b) Find the diameter of the bolt of the arrangement shown in fig.1 Assume material of bolt $s_y = 350$ MPa and FOS = 3.5   (08)

Fig. 1
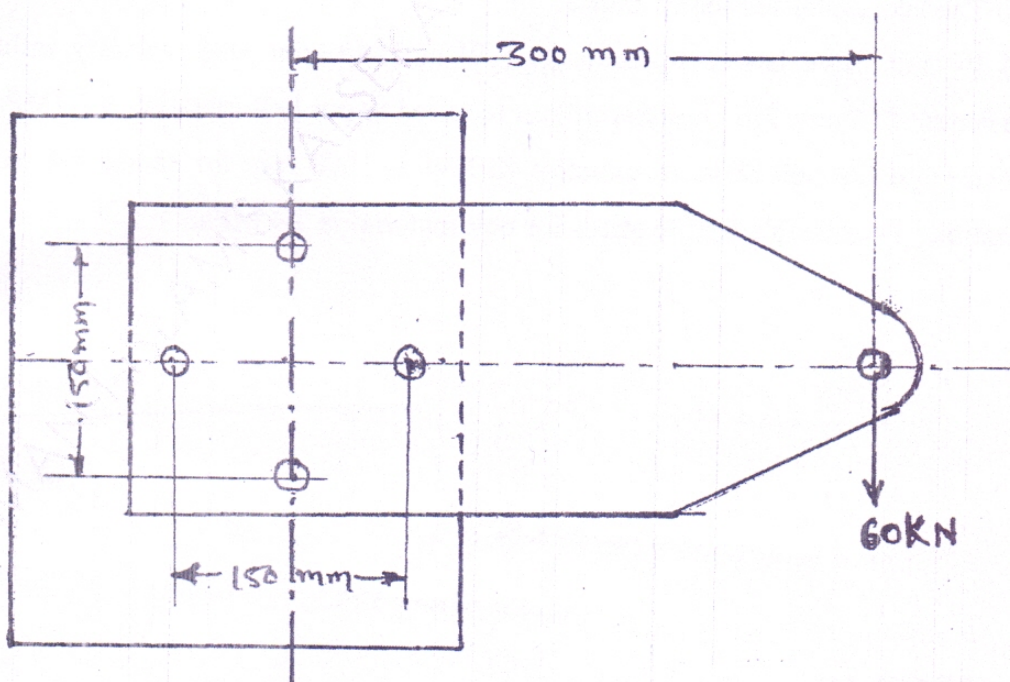
Qu.4 The input shaft of a machine is supported in bearings at A & D it receives 40 KW powerthrough a flat belt pulley, 400mm diameter located at B from a pulley located vertically below. The angle of lap is 225^0 and the coefficient of friction between belt and pulley is 0.25. The shaft rotates at 400rpm in anticlockwise direction when viewed from D and delivers power through a pinion having 20 teeth and 6 mm module having pressure angle of 20^0 located at C it transmits power to agear located horizontally in front.

The material for the shaft is 15-C-48 and FOS is 4 determine the shaft diameter. (20)

Qu.5 a) A helical compression spring is subjected to a force of 500 N with corresponding deflection of 20 mm. The spring index is 6. The spring material has UTS of $1000N/mm^2$. The permissible shaer stress for spring wire is 50% of UTS Modulus of rigidity is $8 \times 10^4 \, N/mm^2$.

Design the spring and determine (16)

    1) Wire diameter

    2) Mean coil diameter

    3) Number of active turns

    4) Free length.

    b) What do you understand by nipping with reference to leaf spring? (04)

Qu. 6 a) Explain different types of threads with their advantages and disadvantages. (04)

    b)Screw press is subjected to load of 120KN, Hight of screw is 800 m, frame overhang is 400 mm, Design (16)

    i) Screw and Nut

    ii) The horizontal section of frame.

Qu. 7 a) V- belt drive has to transmit 20 KW at 1440 rpm with velocity ratio 2.2. decide optimum center distance. Find number of belt required as per belt material is 2.4MPa. (08)

    b) Design flat belt drive to transmit 40 KW at 1000 rpm for center distance of 3m and velocity ratio 2. Permissible tensile stress for belt material is 2.4 MPa. (12)