(c) It is required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.4 kW power at 175 rpm to the output shaft through the coupling. The design torque is 1.5 times of the rated torque. Select suitable material for various parts of the coupling, design the coupling and specify the dimensions of its components.

4. Attempt any **two** parts of the following : **(6×2=12)**

(a) What types of stresses produced in the wire of a closed coiled helical spring ? Draw the distribution of stresses.

(b) A helical valve spring is to be designed for an operating load range of 9 N to 140 N. The 90 N load acts when the valve is closed and the 140 N force acts when the valve is open. The deflection of the spring is limited to 8 mm. Take G = 84 GPa.

(c) Design a screw jack for lifting a load of 20 kN through 200 mm.

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2101 **Roll No.** | | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2013-14

MACHINE DESIGN—I

Time : 2 Hours *Total Marks : 50*

Note :— Attempt **all** questions. Design data books are allowed in Examination Hall. Any missing data may be assumed suitably.

1. Attempt any **four** parts of the following : **(3.5×4=14)**

(a) What is preferred numbers ? How will you find the numbers belonging to R10 series ?

(b) What is fatigue failure of material ? Explain the mechanism of such failures.

(c) What is 25Cr4Mo2 designation of steel ? What is the average percentage of various constituents in this steel ?

(d) A bolt is subjected to an axial pull of 10 kN and transverse shear force of 5 kN. The yield strength of the bolt material is 300 MPa. Considering the factor of safety of 2 determine the diameter of shaft using (i) maximum shear stress theory and (ii) distortion energy theory.

(e) A flat bar as shown in the Figure 1 is subjected to an axial load F equal to 500 N. Assuming that the stress in the bar

is limited to 200 MPa, determine the thickness of the bar. All dimensions are in mm.

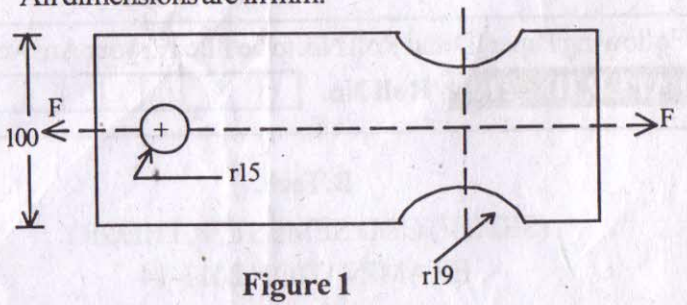

Figure 1

(f) What are fluctuating and repeated stresses ? Draw a stress-time curve for fluctuating and repeated stresses.

2. Attempt any **two** parts of the following : **(6×2=12)**

(a) What is Caulking and fullering in riveted joint ? Determine the diameter of rivet for the structural join shown in Figure 2, if the permissible shear stress is 70 MPa.

(b) A cantilever beam made of cold drawn steel 40 C8 (σ_{ut} = 600 MPa and σ_{yt} = 380 MPa) is shown in Figure 3. The force P acting at free end and varies from –50 N to + 150 N. The expected reliability is 90% and factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter d of the beam at the fillet section. All dimensions are in mm.

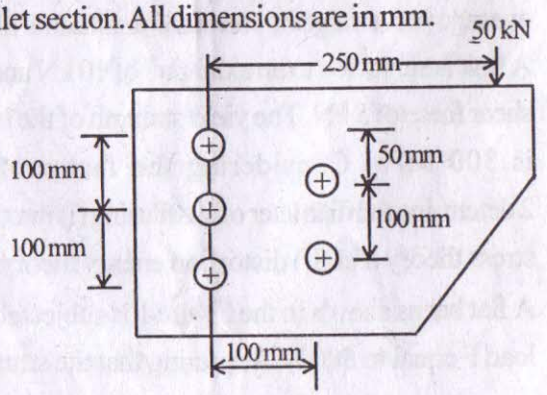

Figure 2

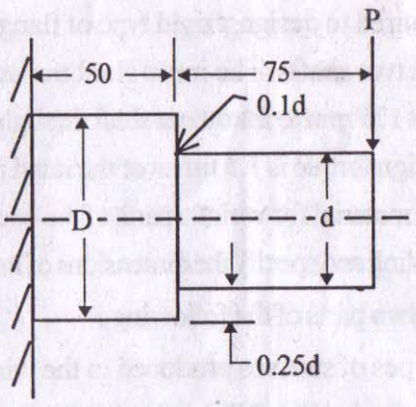

Figure 3

(c) What is notch sensitivity ? Define notch sensitivity factor. A forged steel bar 50 mm in diameter is subjected to a reversed bending stress of 300 MPa. The bar is made of 40C8. Calculate the life of the bar for a reliability of 90%.

3. Attempt any **two** parts of the following : **(6×2=12)**

(a) A shaft is subjected to bending moment varying from –200 N m to +500 N m and a varying torque from 50 N m to 175 N m. If material of the shaft is 30C8, stress concentration factor is 1.85, notch sensitivity is 0.95 reliability 99.9% and factor of safety is 1.5, find the diameter of the shaft.

(b) It is required to design a square key for fixing a pulley on the shaft, which is 50 mm in diameter. The pulley transmits 10 kW power at 200 rpm to the shaft. The key is made of steel 45C8 ($\sigma_{yt} = \sigma_{yc} = 380$ N/mm^2) and the factor of safety is 3. Determine the dimensions of the key. Assume ($\sigma_{sy} = 0.577\ \sigma_{yt}$).