BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
First Semester 2022-23 **Open Book (Text Book & Class Note only)**
ME F314 / MF F314 Design of Machine Elements
Mid-Semester test
Date: **October 2022** Max Marks: **60 (30%)** Max. Time: **90 minutes**

Q1. A petrol engine valve regulated by a spring needs to be designed. Essentially following parameters to be determined (wire diameter, coil diameter, number of active coil, free length, pitch of coil) for the following specifications:

a) Spring load when the valve is open is 400 N and corresponding length of spring 40 mm
b) Spring load when the valve is closed is 260 N and corresponding length of spring 48 mm
c) Minimum permissible inside diameter of spring coil is 25 mm
d) Maximum allowable shear stress in spring is 400 MPa
e) Modulus of rigidity of spring is 85 GPa
f) Clearance between coils of unloaded spring is 0.5 mm

[5X4=20]

Q2. A welded joint with identical throat fillet on the horizontal bar which supports a load of 3kN as shown in Figure Q2 is to be designed. The welding is carried out employing an automated robot using standard E60xx welding rod with a factor of safety 2.2. Find the required weld size 'h' in the joint. Show all steps worked out in details.

[20]

Q3. A screw jack having Acme thread profile of outer diameter 30 mm has quadruple start thread, with pitch 4 mm. It is used to lift a load of P = 6 kN. The coefficient of friction at thread and collar are 0.12 and 0.09 respectively. Find

i) Lead of screw, Mean diameter of screw and Helix angle
ii) Evaluate and write clearly whether the screw is self-locking or over-howling.
iii) Considering mean coil diameter 40 mm, find the starting torque for lifting and lowering the screw.
iv) If an operator can conveniently apply a force of 150 N with hand, what is the minimum length of the crank for the screw jack?

[4X5=20]

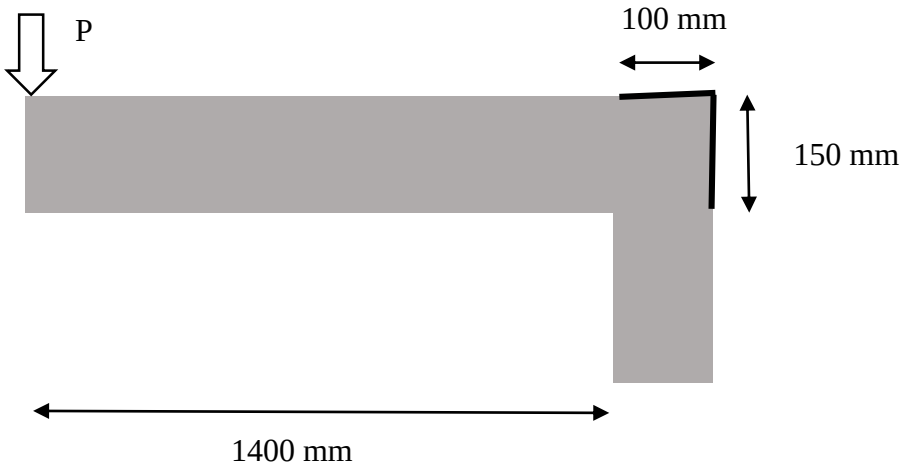

Figure Q2