BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
First Semester 2023-24 **Open Book (Text Book & Class Notes only)**
ME F314 / MF F314 Design of Machine Elements
Mid Semester Examination
Date: **09/10/2023**   Max. Time: **90 minutes**
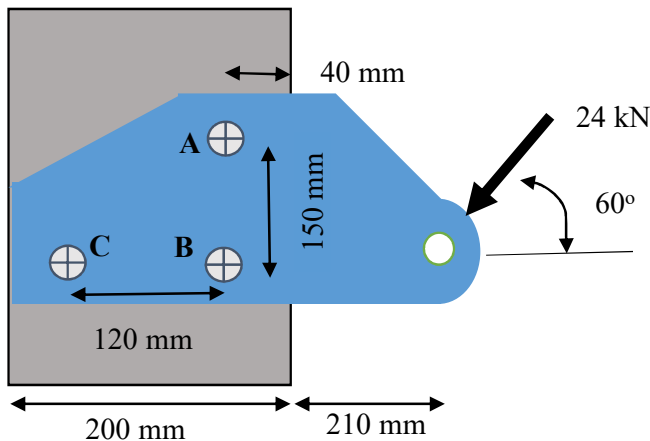   Max Marks: **30**

Q1) A wall mounted steel bracket, 5 mm thick, as shown in Fig. Q1 is supported by three bolts A, B & C.
a) Find the critically loaded bolt, showing all calculations and assumptions made. b) If the bolt material has allowable shear strength 80 MPa, find the recommended standard bolt size.   [4+6=10]

Q2) A solid circular shaft of diameter 40 mm, simply supported at two ends, carries five, equally spaced torsional loads along its span at A, B, C, D and E as shown in Fig. Q2. The chosen shaft material is AISI 4130 Normalized steel and G=80 GPa
a) Draw a neat torque distribution diagram
b) Find the magnitude of maximum shear stress due to torsion and where it occurs
c) Angular deflection of point E with respect to point A in the shaft
d) What is the factor of safety of the design?
e) If the angular defection per meter length to be restricted within 1 degree, suggest suitable material for the shaft, mention what considerations you will take to decide upon the material.
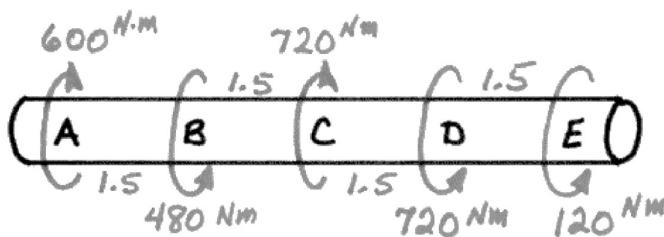   [2+4+2+2+2=12]

Figure Q2 [all dimension in m]

 Q3) A screw jack has double start square thread of 100 mm mean diameter and 20 mm pitch. It is used to raise or lower a car of mass 1800 kg. The axial thrust on the jack is borne by a collar with outer diameter 250 mm and inner diameter 100 mm. Given coefficient of friction at the thread and at the collar are 0.15 and 0.2 respectively.
a) Determine the horizontal force required at the end of a 400 mm handle bar to lift and lower the car
                                                                                         [8]

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