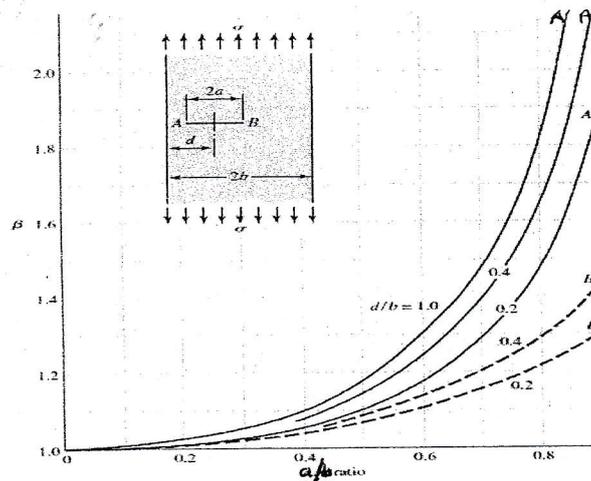


((Answer only four questions))

Q1 :- A- What are the steps that to be taken into consideration for design a shaft (as case study)? (10)

B- A steel ship deck plate is 90 mm thick, 12 m wide, and 20 m long (in the tensile stress direction). It is loaded with a nominal tensile stress of 50 MPa. It is operated below its ductile to brittle transition temperature with  $K_{tc}$  equal to 28.3 MPa. If a 65 mm long central transverse crack is present, estimate tensile stress at which catastrophic failure will occur. Compare this stress with yield strength of 240 MPa for this steel. (Hint: From Figure, take  $d/b = 1$  and find  $\beta$ ) (15)

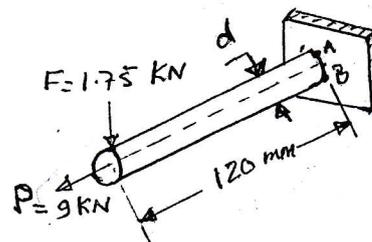


Q2:- A- What are the factors to be considered for selection of materials for the design of machine elements? Discuss. (10)

B- A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. (15)  
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.

Q3 :- A- What are the steps of approach systematic design? (10)

B- A circular cantilever rod, show in Fig. below, is to be made from a ductile material with Yield strength of 276 MPa. Using design factor  $N = 2$ , find the appropriate diameter (d). (15)



**Q4 :- A- What is the expression (MDMC) means and what are the stages of this process? (10)**

**B- A hydraulic press exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper head of the press. If the stress is 85 MPa and  $E = 210 \text{ KN/mm}^2$ . Find ; 1- diameter of the rods, 2- extension in each rod in a length of 2.5 m. (15)**

**Q5:- A- Define the design strategy and how can this strategy helping to resolve common design problems? (10)**

**B- Power of 90 kW at 750 r.p.m. is to be transmitted from an electric motor to compressor Shaft at 300 r.p.m by V-belt. The large pulley diameter is 1500 mm, and the approximate center distance is 1650 mm. A belt with cross-sectional area of  $350 \text{ mm}^2$  and density  $1000 \text{ kg/m}^3$  and having an allowance tensile strength of 2 MPa , the coefficient of friction between the belt and the pulley may be taken as 0.28. Find the number of V-belts needed. (15)**

**----- Good Luck -----**