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Paper Code : PC-MC602 Design of Machine Elements
UPID : 006618

Time Allotted : 3 Hours | Full Marks :70

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(i) What is the purpose of nipping in multi leaf spring?
(ii) What is the minimum percentage of carbon in Cast Iron?
(iii) For the design of shafts which failure theory is to be applied?
(iv) What is Endurance limit?
(v) What is Unwin's formula for rivets?
(vi) Which type of stresses are induced in the shaft?
(vii) What is the specification of a typical V belt?
(viii) Write down two nos applications of Buttress thread.
(ix) Which type of bearing is used where misalignment is likely to occur?
(x) Write down the specification some common shaft material.
(xi) What is the difference between Resilience and Toughness of material?
(xii) How is the S-N curve of Al alloy?

Group-B (Short Answer Type Question)

Answer *any three* of the following : [5 x 3 = 15]

2. A machine vice has single start square thread of 22 mm nominal dia and 5 mm pitch. The friction collar outer and inner diameters are 55 mm and 45 mm . The coefficient of friction for the thread and collar are 0.15 and 0.13 . The machine can exert aforce of 125 N on the handle at amean radius of 150 mm . Assuming uniform wear for the collar calculate the clamping force developed between jaws . [5]
3. A pair of gear consists of a 20 teeth pinion and a120 teeth gear. The module is 4 mm. Determine the 1) Centre distance 2) PCD of pinion and gear 3) Gear ratio [5]
4. A shaft of 750 mm long is subjected to shear stress of 40 MPa and the angle of twist is 0. 017 radians. Determine the diameter of the shaft $G = 0.8 \times 10^5$ MPa. [5]
5. Compare the strength of a solid steel column to that of a hollow column of same cross section, Inside diameter of the hollow column is 3 /4 th times the outer diameter. Both the columns are pinned at both ends and their lengths are same. https://www.makaut.com [5]
6. What are the design considerations for the design of machined parts? [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following : [15 x 3 = 45]

7. What is the step by step basic procedure of Machine Design ? Describe each step in detail with suitable examples. [15]
8. (a) What is Factor of Safety? How to derive the allowable stress of ductile/ brittle materials? [5]
   (b) What are the guidelines for the selection of FOS for different type of materials, type of loads, components, service condition etc.? [10]
9. Design a rigid type of Flange Coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The service factor for the application is 1.5 , i.e the design torque is 1.5 times the rated torque. Select suitable materials for various parts of the coupling. Design the coupling and specify the dimensions of the components. [15]
10. (a) What are the important mechanical properties of engineering materials? [5]
    (b) Describe the properties and mention their significant importance in the selection of materials for different machine elements. [10]

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11. (a) A circular shaft 50 mm diameter is welded to the vertical plate as a cantilever beam by fillet welding . It is subjected to a torsional moment of 2500 Nm . Determine the size of the fillet weld, permissible shear stress in the weld is limited to 140 N / mm^2. [7]

(b) A horizontal cantilever beam 500 mm long and is of rectangular cross section 100 mm width and 150 mm height is fillet welded on all sides to a vertical support. A vertical load of 25 kN acts at the free end of the beam. Determine the size of the welds if the permissible shear stress is 75 N /mm^2. [8]

END OF PAPER ***

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