Total No. of Questions : 10]

P2546

SEAT No. :

[Total No. of Pages :4

[5153]-511

T.E. (Mechanical)
DESIGN OF MACHINE Elements-I
(2012 Pattern) (Semester-I) (302041) (End-Semester)

Time : 3 Hours]

[Max. Marks :70

Instructions to the candidates:

1) *Answer Five questions from following.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Use of programmable calculator is not permitted.*
6) *Assume suitable data if necessary.*

Q1) a) Explain the following. **[6]**
  - Factor of safety and service factor.
  - Preferred series.
  - Mechanical Advantage.

  b) Design a Key for muff coupling which connect two shaft of 29 mm diameter, transmits 35 KW at 1440 rpm. The maximum torque is 25% greater than average torque. Allowable shear stress and crushing stress for key material are = 65 N/mm^2 and 160 N/mm^2. **[4]**

OR

Q2) a) Classify Keys Also prove that crushing stress in key material is twice the shear stress. **[4]**

  b) Draw neat labeled sketch Cotter joint. Write design steps and state their applications. **[6]**

Q3) a) A line shaft rotating at 200 rpm is to be transmitted 20 KW. The shaft is made of M.S. With allowable shear stress 42 Mpa. Determine the diameter of shaft. **[4]**

  b) A forged steel made with 40 C8 of 50 mm diameter is subjected to completely reversed bending stress of 300 N/mm^2. Determine the life of bar. Use following data: **[6]**
  - Sut=600N/mm^2.
  - Surface Finish Factor=0.43
  - Size Factor=0.85
  - Reliability factor=0.897 at 90% reliability.
  - Factor of safety=1.5
  - Notch sensitivity=0.8
  - Theoretical stress concentration=2.6

OR

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Q4) a) A cantilever of beam made of cold drawn steel 40C8 with Sut=600 N/mm^2 and Syt 380 N/mm^2 The maximum and minimum force at free end varies from – 50 N to + 150 N. Reliability factor is 0.897, surface finish factor and size factor are 0.77 and 0.85 respectively. Notch sensitivity at fillet is 0.9 and theoretical stress concentration factor is 1.44. If factor of safety is 2 determine diameter of beam according to Goodman's criteria. Assume effective length of beam 100 mm. **[6]**

b) Explain Design of shaft based on Tensional Rigidity. **[4]**

Q5) a) Explain with neat sketch Differential screw. **[4]**

b) A Power screw having double start square threads nominal diameter 25 mm and pitch 5 mm subjected to axial load of 1000 N. The outer and inner diameter of the screw coller is 50 and 20 mm respectively . The coefficient of friction for collar thread and screw thread are 0.15 & 0.20 respectively. The screw rotates at 12 rpm. Assume uniform wear condition, and allowable bearing pressure is 5.77 N/mm^2. Determine, **[12]**

   i) Power required to rotate the screw.

   ii) Stresses in screw Body & threads.

   iii) No. of threads of nut in engage with screw.

OR

Q6) a) Following data refers to C-Clamp. **[13]**

- Maximum clamping force=4000N.
- Screw type – Single start trapezoidal threaded.
- Nominal Diameter = 12 mm.
- Pitch=2mm.
- Coefficient of collar friction=0.25.
- Coefficient of screw friction=0.12.
- Mean collar Diameter=12mm.
- Operator force at the end of handle=80N.
- Distance between the axis of handle and surface of nut in clamped condition=150 mm.
- Nut height = 25 mm.

   Determine,

   i) Length of handle if 50 mm additional length for gripping.

   ii) Stresses in screw body at two critical sections.

   iii) Bearing Pressure on screw thread.

b) Explain self locking and overhauling of power screw. **[3]**

Q7) a) Explain with neat sketch any two types of screw fastenings. **[6]**

b) A cylindrical head is connected to a flange by 12 bolts, The inside diameter of cylinder is 480 mm & maximum pressure inside is 1.5 N/mm² if bolt have permissible shear strength of 80 N/mm² Determine the size of bolt neglecetin initial tightening. If for the same application. M 30 bolts are used, find number of bolts required. **[12]**

OR

Q8) a) Write advantage of welded joints over thread joints. Also prove that stress acting on throat is equal to force on weld upon 0.707hl where h=leg size of weld and 1 = length of fillet weld . **[6]**

b) A welded bracket is shown in figure 1 below, carries a load of 60 KN. Calculate size of weld if shear stress in weld is 100 N/mm². **[12]**
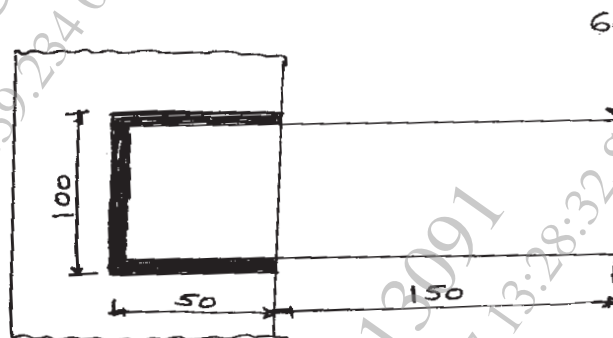
Figure – 1 (Q No- 8 b)

Q9) a) Draw a neat labeled sketch of Laminated leaf spring. State function of any two components. **[5]**

b) Following data is given for helical compression spring. **[11]**

• Axial load=8000N.

• Spring rate=72N/mm.

• Mean coil diameter=125mm.

• Tensile strength of spring material=550 Mpa.

• Modulus of rigidity = 80000 Mpa.

• Permissible shear stress for spring wire is half the tensile strength of spring material.

• Standard Spring Wire diameter = 18,19,20,21,22,23,24,25,27,29,30 mm

    Determine   i)   Wire diameter

                    ii)   No. of active coils.

OR

*Q10)*a)   Explain the following terms.   **[4]**

     i)   Wahl's factor.

     ii)   Active and Inactive coils.

   b)   A composite compression spring has two closed coil. Outer spring is of 15 mm longer than inner spring. The outer spring has 10 coils of mean diameter 36 mm & wire diameter 6 mm. The inner spring has 8 coils of mean daimeter 30 mm & wire diameter 5 mm. When spring is subjected to an axial load 1000 N, Modulus of rigidity may be taken as 81370 N/mm². Find.   **[12]**

     i)   Compression of each spring

     ii)   Load shared by each spring.

     iii)   Shear stress induced in each spring.

✡   ✡   ✡