SUBJECT CODE:- 448
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(MECH/PROD) Examination Nov/Dec 2015
Design of Machine Elements-I
(Revised)

[Time: Three Hours]   [Max. Marks: 80]

"Please check whether you have got the right question paper."
N.B i) Solve any three questions from each section.
       ii) Use separate answer book for each section
       iii) Figures to the right indicate full marks.
       iv) Assume suitable data, if necessary and state them clearly.

Section A

Q.1 a) Explain in detail the basic procedure of machine design   04
      b) Define the following: 04
           i)   Toughness ii) Malleability iii) Plasticity   iv) Resilience
      c) State the meaning of the following designation: 04
           i)   X15Cr20Ni14   ii) WM200 iii) 30Cr4Mo2 iv) 30C8

Q.2 A machine member 40mm diameter by 200mm long is supported at one end as cantilever beam which is subjected to a   12
      tensile force of 25kN and bending force of 5kN and torque of 2kNm. Calculate the maximum, minimum normal stress and
      maximum shear stress.

Q.3 Design a socket and spigot joint used to connected two coaxial shafts subjected to a tensile force of 50kN. The material to   12
      be selected for the joint is 30C8 (S_{yt} =400MPa).draw a neat sketch and specify major dimensions.

Q.4 A bracket is attached to a steel column by means of four identical bolts two at A and B respectively. The maximum load that   12
      comes on the bracket is 7kN acting vertically downward distance of 260mm from the face of the column. The bolts are
      made of steel 40C8 (Syt =400MPa) and the factor of safety 4. Determine the major diameter of the bolts on the basis of
      maximum principle stress. Assume (d_c=0.8d).
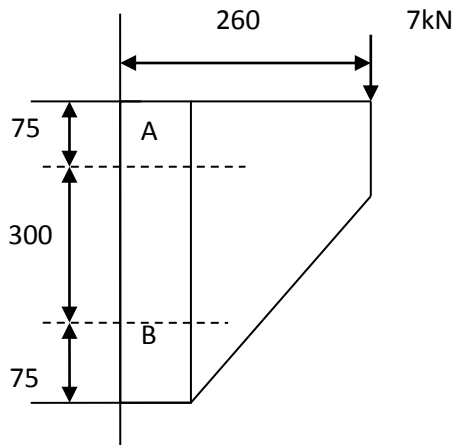

Figure. 1

Q.5 Write short notes (any four)   16
           a) Design of lever
           b) Self locking screw.
           c) ASME code of shaft design
           d) Knuckle joint design procedure
           e) Ergonomic consideration in design.

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SECTION B

Q.6 A welded connection is used to join two steel plates as shown in the figure 2 is subjected to an eccentric force of 15kN. **12** Determine the throat dimensions of the welds the permissible shear stress is limited to 100 MPa. Assume static conditions.
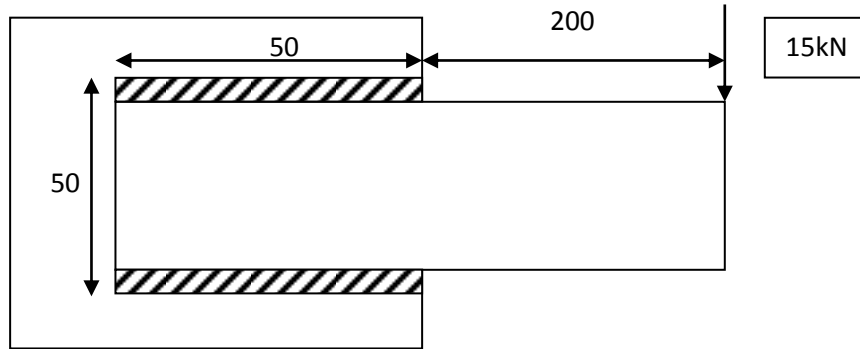

Figure.2

Q.7 a) Explain stress concentration causes and remedies to reduce stress concentration **04**

   b) A circular machine member of ductile material is subjected to varying axial load that varies from 3500N (compressive) to **08** 8500N (tensile). The endurance limit =250N/mm², tensile yield stress=350N/mm². Assume stress concentration factor of 1.8 and factor of safety = 2. Calculate the diameter of the member.

Q.8 a) Derive the expression series and parallel connections for helical compression spring **06**

   b) A safety valve of 40mm diameter is to blow off at a pressure of 1.2MPA. It is held on the seat by means of helical **06** compression spring, with initial compression of 20mm. The maximum valve lift is 12mm. The spring index is 6. The spring is made of cold drawn steel wire with ultimate tensile strength 1400MPa. The endurance strength is taken as 50% of this strength. (G = 81370MPa). Calculate wire diameter, mean coil diameter and number of active coils.

Q.9 A helical compression spring of a mechanism is subjected to an initial pre load of 50N and maximum force during the load **12** cycle is 400N. The wire diameter is 5mm while spring index is 5. The spring is made of oil hardened and tempered steel wire of Grade SW (S_{ut} = 1440MPa). Determine the factor of safety against fluctuating stresses
Assume ($S'_{se} = 0.22\ S_{ut}\ and\ S_{sy} = 0.45\ S_{ut}$)

Q.10 Write short notes on (any four) **16**
   a) Goodman's equation.
   b) Techniques for weld inspection.
   c) Surge in helical compression spring.
   d) Nipping in multi leaf spring.
   e) Cumulative fatigue damage.

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