Total No. of Questions :10]

SEAT No. :

P3567

[Total No. of Pages :3

[5560]-511
T. E. (Mechanical)
DESIGN OF MACHINE ELEMENTS-I
(2015 Pattern) (Semester - I) (302041)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer five questions from the following.***
2) ***Draw neat labeled diagrams wherever necessary.***
3) ***figures to the right side indicate full marks.***
4) ***Use of non programmable electronic calculator is permitted.***
5) ***Assume suitable/standard data if necessary.***

Q1) a) Write in brief use of standards in design on machine element. What are three basic types of standards used in a design office? **[4]**

b) The Standard cross section for a flat key, which is fitted on a 50mm diameter shaft, is 16×10mm. The key is transmitting 475Nm torque from the shaft to the hub. The key is made of commercial steel (S_{yt}=S_{yc}=230 N/mm^2). Determine the length of the key, if the factor of safety is 3. **[6]**

OR

Q2) a) Classify the keys and explain it with neat diagram. **[4]**

b) Write design steps of cotter joint and state their applications. **[6]**

Q3) a) Explain different methods of reduction of stress concentration. **[4]**

b) A propeller shaft is required to transmit 45 kW power at 500 rpm. It is a hollow shaft, having an inside diameter 0.6 times of outside diameter. It is made of plain carbon steel and the permissible shear stress is 84 N/mm^2. Calculate the inside and outside diameters of the shaft. **[6]**

OR

Q4) a) Explain the design procedure for rigid flange coupling. **[6]**

b) Explain the Soderberg and Goodman line diagram with neat sketch. **[4]**

P.T.O.

Q5) a) Explain different forms of threads with neat sketch. **[4]**

b) A double threaded power screw, with ISO metric trapezoidal threads is used to raise a load of 300kN. The nominal diameter is 100 mm and the pitch is 12mm. The coefficient of friction at the screw threads is 0.15. Neglecting collar friction.

Calculate

i) Torque required to raise the load;

ii) Torque required to lower the load;

iii) Efficiency of the screw. **[12]**

OR

Q6) a) Explain Re-circulating ball screw with neat sketch and its applications. **[4]**

b) The lead screw of a lathe has single start ISO metric trapezoidal threads of 52 mm nominal diameter and 8mm pitch. The screw is required to exert an axial force of 2kN in order to drive the tool carriage during turning operation. The thrust is carried on a collar of 100 mm outer diameter and 60mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30 rpm.

Calculate

i) The power required to drive the lead screw;

ii) The efficiency of the screw. **[12]**

Q7) a) What are the advantages of welded joints and threaded joints? **[8]**

b) Explain eccentrically loaded bolted joints in shear. **[10]**

OR

Q8) a) A steel plate 100 mm wide and 10mm thick is welded to another steel plate by means of double parallel fillet welds. The plates are subjected to a static tensile force of 50kN. Determine the required length of welds if the permissible shear stress in the weld is 94 N/mm^2. **[12]**

b) Explain and draw the neat sketch of cap screws. **[6]**

Q9) a) Explain and draw the neat sketch of the styles of ends of helical compression spring. **[6]**

b) Design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30mm. The spring index can be taken as 6. The spring is made of patented and cold drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 and 81370 N/mm^2 respectively. The permissible shear stress for the spring

wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate,

i) Wire diameter;
ii) Mean coil diameter;
iii) Number of active coils;
iv) Total number of coils;
v) Free length of the spring;
vi) Pitch of the coil. **[10]**

OR

Q10)a) What is meant by spring surge and explain its effect. **[4]**

b) A railway wagon moving at a velocity of 1.5 m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500kg. The springs are compressed by 150 mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil hardened and tempered steel wire with ultimate tensile strength of 1250N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength.Calculate:

i) Wire diameter;
ii) Mean coil diameter;
iii) Number of active coils;
iv) Total number of coils;
v) Solid length of the spring;
vi) Free length of the spring;
vii) Pitch of the coil;
viii) Required spring rate;
ix) Actual spring rate. **[12]**

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