B.E.(Aeronautical Engineering) Semester Seventh (C.B.S.)
Design of Machine Elements

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Notes :   1.   All questions carry marks as indicated.
          2.   Solve Question 1 OR Questions No. 2.
          3.   Solve Question 3 OR Questions No. 4.
          4.   Solve Question 5 OR Questions No. 6.
          5.   Solve Question 7 OR Questions No. 8.
          6.   Due credit will be given to neatness and adequate dimensions.
          7.   Assume suitable data wherever necessary.
          8.   Illustrate your answers whenever necessary with the help of neat sketches.
          9.   Use of non programmable calculator is permitted.

1.   a)   Explain various properties of the material which determine the utility of them.   **5**

         b)   What are the factors that are to be considered during the selection of any material.   **5**

         c)   Find the diameter of a solid. Steel to transmit 20 KW at 200rpm. The ultimate shear stress   **10**
              for steel may be taken as 360 N/mm^2 and factor of safety as 8.
              If the hallow shaft is to be used in place of the solid shaft, find inside and outside
   diameter, when the ratio of inside and outside diameter is 0.5

OR

2.   a)   Discuss the factors governing the selection of material to design a machine element.   **5**

         b)   Explain the general process adopted in machine design elements with examples.   **5**

         c)   A solid circular shaft is subjected to a bending moment of 3000 N-mtr. and a torque of   **10**
              10,000 N-Mtr. The shaft is made of steel having Ultimate tensile stress of 700N/mm^2 and
              Ultimate shear stress of 500 N/mm^2. Assuming a factor of safety as 06. Determine the
              diameter of the shaft.

3.   a)   How are the keys classified? Draw the neat sketches of different types of keys and state   **6**
              their applications.

         b)   A 45mm diameter shaft is made of steel with a yield strength of 400 N/mm^2. A Parallel   **14**
              keys of size 14mm wide and 09mm thick made of steel with a yield strength of 340
              N/mm^2 is to used. Find the required length of key. is the shaft is loaded to transmit the
              maximum permissible torque. Use the maximum shear stress theory and assume a factor
              of safety of 02.

OR

4.   a)   What do you mean by the term welded joint? How it differ from riveted joint.   **6**

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b) A steel plate, 100mm wide and 10mm thick, is joined with another steel plate by means of a single transverse and double parallel fillet welds as shown in fig. The strength of the welded joint should be equal to the strength of the plats to be jointed. The permissible tensile and shear stress for the weld material and the plates are 70 N/mm^2 and 50 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume the tensile force acting on the plates are static. **14**
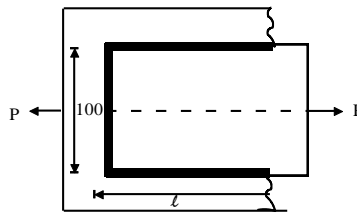
5. a) What are the different types of stresses induced in helical compression spring, when it is subjected to axial load. **5**

b) A mechanism used in a machinery consists of a tension spring assembled with a preload of 30 N. The wire diameter of spring is 2mm. With a spring index of 6. The spring has 18 active coils. The spring wire is hard drawn and oil tempered having following material properties. Design shear stress = 680 N/mm^2 Modulus of rigidity = 80 KN/mm^2. Determine : (i) the initial torsional shear stress in wire (ii) spring rate (iii) the force to cause the body of the spring to its yield strength. **15**

OR

6. a) What are rolling contact bearing? Discuss their advantages over sliding contact bearings. **5**

b) It is required to design a pair of a spur gear with 20º full depth involute teeth based on Lewis equation. The velocity factor is to used to account for dynamic load. The pinion shaft is connected to a 10 KW, 1440rpm motor. The starting torque of the motor is 140 percent of the rated torque. The speed reduction is 4:1. The pinion as well as the gear is made of steet, (Sut = 600 N/mm^2). The factor of safety can be taken as 1.5. Design the gears, specify their dimensions. **15**

7. a) Explain the important parameters required for selection of a belt drive for power transmission. **6**

b) It is required to design a V- belt drive to connect a 7.5 KW, 1440rpm induction motor to a fan, running at approximately 480rpm, for a service of 24hr. Per day, space available for a center distance of about 1 Mtr. **14**

OR

8. a) What is the coefficient of fluctuation of energy and coefficient of fluctuation of speed of flywheel? Derive the relation between them. **5**

b) A punching press pierces 35 holes per minutes in a plate using 10 KN-m of energy per hole during each revolution. Each piercing takes 40 percent of the time needed to make one revolution. The punch receives power through a gear reduction unit which in turn is fed by a motor driven belt pulley 800mm diameter and turning at 210rpm. Find the power of electric motor if overall efficiency of the transmission unit is 80% design a C.I flywheel to be used with the punching machine for a coefficient of steadiness of 5, if the space considerations limit the maximum diameter to 1.3mtr. **15**
   i) Allowable shear stress in the shaft material = 50 N/mm^2
   ii) Allowable tensile stress for C.I = 4 N/mm^2
   iii) Density of cast irom [C I] = 7200 kg/m^3

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