

B.TECH SEM – V (2007 COURSE) (MECHANICAL ENGG.) :

WINTER - 2017

SUBJECT: MACHINE DESIGN –I

Day: **Saturday**
Date: **13/01/2018**

W-2017-2475

Time: **02.30 PM TO 06.30 PM**
Max. Marks: **80**

N.B.:

- 1) **Q. No. 1 and Q. No. 5** are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each section.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SEPARATE** answer book.
- 4) Assume suitable data if necessary.

SECTION-I

- Q.1**
- a) Explain various phases involved in the process of design of machine elements. **(05)**
 - b) Draw a neat sketch of four types of sunk keys. **(04)**
 - c) What are the different types of screw threads used in power screw? **(05)**
- Q.2**
- a) Explain design considerations in knuckle Joint. **(08)**
 - b) What are the factors to be considered for deciding the magnitude of factor of safety? **(05)**
- Q.3**
- a) Find the diameter of a solid steel shaft to transmit 20kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter, when the ratio of inside to outside diameter is 0.5 **(08)**
 - b) Explain the design considerations in flange coupling. **(05)**
- Q.4**
- A power screw having double starts square threads of 25mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10kN. The outer and inner diameters of screw collar are 50mm and 20mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12rpm. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8N/mm^2 . Find
- i) The torque required to rotate the screw
 - ii) Stress in the screw
 - iii) The number of threads of nut in engagement with screw.

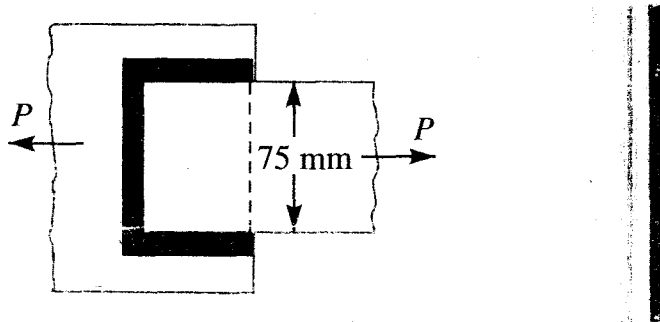
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SECTION-II

- Q.5** a) How to reduce stress concentration due to V-notch. (05)
 b) Explain the factors to be considered in the selection of material for the spring. (05)
 c) What are the advantages and limitations of welded joint? (04)

Q.6 A helical spring is made from a wire of 6mm diameter and has outside diameter of 75mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84kN/mm^2 . Find the axial load which the spring can carry and the deflection per active turn. (13)

Q.7 A plate 75mm wide and 12.5 mm thick is joined with another plate by single transverse weld and double parallel fillet weld as shown in fig. The maximum tensile and shear stresses are 70 MPa and 56 MPa respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading. Assume: stress concentration factor for transverse weld is 1.5 and for parallel fillet weld is 2.7. (13)



- Q.8** a) The work cycle of a mechanical component, subjected to completely reversed bending stresses consists of the following three elements: (10)
 i) $\pm 350 \text{ N/mm}^2$ for 85% of time
 ii) $\pm 400 \text{ N/mm}^2$ for 12% of time
 iii) $\pm 500 \text{ N/mm}^2$ for 3% of time
 The material for the component is 50C4 ($S_{ut} = 660 \text{ N/mm}^2$) and the corrected endurance limit of the component is 280 N/mm^2 . Determine the life of the component.
- b) Draw a neat sketch of modified Goodman diagram for Axial and bending stresses. (03)

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