

Total No. of Questions :10]

SEAT No. : 

P1690

[5058]-311

[Total No. of Pages : 4

T.E.(Mechanical)

DESIGN OF MACHINE ELEMENTS -I

(302041) (2012 Pattern)(Semester-I)(End Smester)

*Time : 3 Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) *Answer any 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) *Assume suitable data, if necessary.*

**Q1) a)** Explain the following:**[6]**

- Factor of safety and service factor.
- Standards & codes.
- Preferred series.

b) Two 50 mm shaft are connected by unprotected type flange coupling. The no. of bolts used are 6 on 150 mm bolt PCD. The shaft transmits 30 KW at 750 rpm. for following safe stresses **[4]**

- Shear stress for shaft -  $63 \text{ N/mm}^2$
- Shear stress for flange material -  $10 \text{ N/mm}^2$
- Shear stress for key material -  $46 \text{ N/mm}^2$
- Crushing stress for key material -  $23 \text{ N/mm}^2$

Calculate:

- i) key Dimensions
- ii) Flange Dimensions

OR

**P.T.O.**

- Q2)** a) Classify Keys. Explain why taper is provided on key. [4]  
 b) A hollow circular column of external diameter 250mm and internal diameter 200 mm carries projecting bracket on which a load of 20 KN rests. The centre of load from centre of column is 500 mm. Find the stresses at the sides of column and plot stress distribution plot across circular column.[6]
- Q3)** a) Draw Neat labeled sketch of Un-Protected type flange coupling. [4]  
 b) A forged steel bar of 50 mm diameter is subjected to reversed bending stress of 250 N/mm<sup>2</sup>. Assume there is no stress concentration factor. calculate life of bar. [6]

Use following data:

- $S_{ut} = 600 \text{ N/mm}^2$
- Surface finish factor = 0.43
- Size factor = 0.85
- Reliability factor = 0.897 at 90% reliability
- Factor of safety = 1.5

OR

- Q4)** a) Write a short note on endurance limit modifying factors. [6]  
 b) A shaft transmits 20 KW at 200 rpm. It carries a central load of 1000 N and centrally supported at 2.5 m apart. The allowable shear stress for shaft is 42 Mpa. The shock and fatigue factors for bending & torsion are 1.5 & 1 respectively. Determine shaft diameter by maximum shear stress theory. [4]
- Q5)** a) Explain with neat sketch, re-circulating ball screw. [4]  
 b) A nut and screw combination 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 collar is 50 and 20 mm respectively. The coefficient of friction for collar thread and screw thread are 0.15 & 0.2 respectively. The screw rotates at 12 rpm. Assume uniform wear condition, and allowable bearing pressure is 5.77 N/mm<sup>2</sup>. 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 square 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,

- 1) Length of handle if 50 mm additional length for gripping
- 2) Stresses in screw body at two critical sections
- 3) Bearing Pressure on screw thread

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

**Q7) a)** Explain with neat sketch any four types of screw fastenings. **[4]**

b) With neat sketch write design steps for Turn Buckle, also write any two application. **[6]**

c) A cylindrical head is connected to a flange by 12 bolts, The inside diameter of cylinder is 480 mm & maximum pressure inside is  $1.5 \text{ N/mm}^2$  if bolt have permissible shear strength of  $80 \text{ N/mm}^2$ . Determine the size of bolt neglecting initial tightenings. **[8]**

OR

**Q8) a)** Write advantage of welded joints. Explain primary and secondary shear stress in eccentrically loaded welded joint **[6]**

b) A welded bracket is shown in figure 1 below, carries a load of 30 KN. Calculate size of weld if shear stress in weld is  $80 \text{ N/mm}^2$ . **[12]**

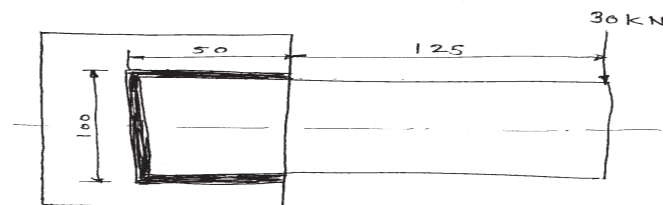


Figure - 1

[ All dimensions are in mm ]

**Q9) a)** Explain the term surge in spring. **[4]**

**b)** Following data is given for helical compression spring **[12]**

- Axial load=8000N
- Spring rate=72 N/mm
- Mean coil diameter=125 mm
- Tensile strength of spring material= 550 MPa
- Modulus of rigidity=80000MPa
- Permissible shear stress for spring wire is half the tensile strength of spring material.
- Standard spring wire diameter=18,19,20,21,22,23,24,25,27,29,30mm

Determine:

- 1) Wire diameter
- 2) No.of active coils

OR

**Q10)a)** Explain different types of stresses induced in helical spring. **[4]**

**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 40 mm & wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm & wire diameter 4 mm. When spring is subjected to an axial load 400 N, Modulus of rigidity may be taken as 84,000N/mm<sup>2</sup>. Find. **[12]**

- i) Compression of each spring
- ii) Load shared by each spring
- iii) Shear stress induced in each spring.

