4E4143

Roll No. _____

Total No of Pages: 4

4E4143

4E4143

B.Tech. IV-Sem (Main & Back) Exam; June-July 2016
Automobile Engineering
4AE4A Design of Machine Elements-I
AE, ME, PI

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks (Main & Back): 26
Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. <u>Design Data Book</u>   2._____

UNIT-I

Q.1 (a) What is standardization? What are the advantages of standardization?   [3+3=6]

   (b) Explain in detail the design considerations of casting with neat sketches.   [10]

OR

Q.1 (a) Write short note on mechanical properties of materials.   [6]

   (b) Explain in detail design considerations of machine parts.   [10]

UNIT-II

Q.2 (a) Write the design procedure of cotter joint.   [8]

[4E4143]   Page 1 of 4   [12680]

(b) It is required to design a square key for fixing a pulley on the shaft, that is 25mm diameter. The shaft is transmitting 15 kW power at 720 rpm. The key is made of steel (S_{yt} = 460 N/mm^2) and the factor of safety is 3. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimension of the key. [8]

OR

Q.2 (a) What is knuckle joint? Where do you use knuckle joint? Give practical examples. http://www.rtuonline.com [4]

(b) The stresses induced at a critical point in a machine component made of steel (Syt = 380 N (mm^2) are as follows [12]

$\sigma x = 100 N/mm^2$

$\sigma y = 40 N/mm^2$

$\tau xy = 80 N/mm^2$

Calculate the factor of safety by

(i) The maximum normal stress theory

(ii) The maximum shear stress theory

(iii) The distortion energy theory

UNIT-III

Q.3 (a) A semi – elliptic leaf spring used for automobile suspension consists of three extra full – length leaves and 15 graduated – length leaves, including the master leaf. The centre – to – centre distance between two eyes of the spring is 1m. The maximum force that can act on the spring is 75 kN. For each leaf, the ratio of width to thickness is 9:1. The modulus of elasticity of the leaf material is 207000 N/mm^2. The leaves are pre – stressed in such a way that when the force is maximum, the stresses in all leaves are same and equal to 450 N/mm^2. [12]
Determine-
(i) The width and thickness of the leaves.
(ii) The initial nip
(iii) The initial pre – load required to close the gap 'C' between extra full – length leaves and graduated length leaves.

(b) What is the objective of shot peening of spring? [4]

OR

Q.3 (a) For a beam made of C.I. given below, determine the dimensions of the cross section.
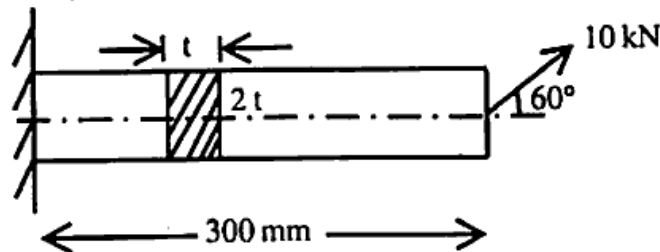
Use followings:

$S_{ut} = 200 \ N/mm^2$

F.S. = 2.5

The depth of cross section is twice of the width.

Use maximum normal stress theory. [12]

(b) What are the second type of lever and third type of lever? Give their examples. [4]

UNIT-IV

Q.4 It is required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. [16]
Use following:

Service factor = 1.5

Allowable shear stress for shaft = $76 \ \dfrac{N}{mm^2}$

Allowable shear stress for keys & bolt = $80 \ \dfrac{N}{mm^2}$

Allowable cruishing stress for keys & bolt = $240 \ \dfrac{N}{mm^2}$

Allowable shear stress for flanges = $16.67 \ \dfrac{N}{mm^2}$

Take Number of bolts = 4

OR

Q.4 (a) A solid shaft of diameter d is used in power transmission. Due to modification of existing system, it is required to replace the solid shaft by a hollow shaft of the same material and equally strong in torsion. Further the weight of hollow shaft per metre length should be half of the solid shaft. Determine the outer diameter of hallow shaft in terms of 'd'. [10]

(b) Explain equivalent twisting moment for shaft. [4]

(c) What do you understand by torsional rigidity? [2]

UNIT-V

Q.5 (a) What do you mean by 'Bolt of uniform strength'? [4]

(b) A wall bracket is attached to a wall by means of four identical bolts, two at A and two at B. Assuming that the bracket is held against the wall and prevented from tipping about C by all four bolts and using an allowable tensile stress in the bolts as 35 N/mm². Determine the size of the bolts on the basis of maximum principal stress theory. [12]
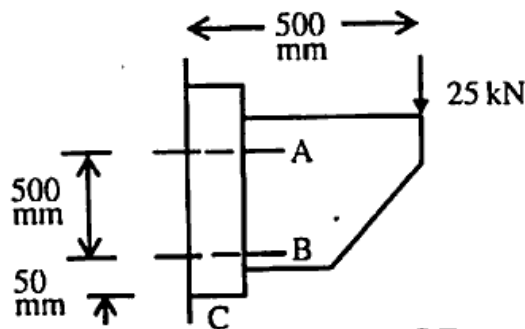
OR

Q.5 (a) Give in detail, the design procedure of screw Jack. [10]

(b) Explain self – locking of power screw. [3]

(c) What do you mean by overhauling of power screw? [3]