15AG5A0301

Code No: 115DV **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2016
DESIGN OF MACHINE MEMBERS – I
(Common to ME, AME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) List any four factors that govern selection of materials while designing a machine component. [2]
b) Define stress concentration along with its causes. Write any one method to reduce stress concentration. [3]
c) What is bolts of uniform strength? [2]
d) What are the reasons of replacing the riveted joints by welded joints in modern equipment? [3]
e) Define the term throat area of the weld. [2]
f) Square key is stronger against crushing than rectangular key justify the statement. [3]
g) With suitable example state when flexible coupling is preferred over the rigid coupling. [2]
h) Define BIS code? State its application in machine design with suitable example. [3]
i) If a single spring is cut into 2 equal pieces what will be the stiffness of each individual spring after cutting. [2]
j) What is nipping? [3]

PART - B

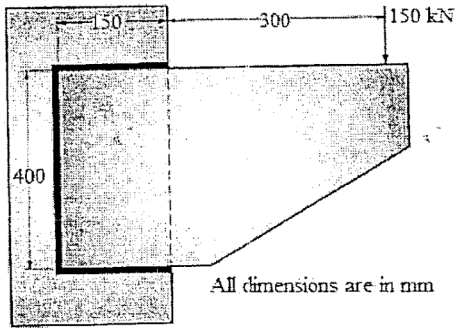
(50 Marks)

2.a) Explain the following theories of failure.
i) Rankine's Theory
ii) Maximum Strain Energy Theory
iii) Saint Venant's Theory.
b) With neat sketch explain how the Sodenberg and Goodman lines differ from each other. [6+4]

OR

3. A cantilever of circular cross section is fixed at one end and subjected to completely reversed force of 10 kN at the free end. The force is perpendicular to the axis of the beam. The distance between the free and fixed end is 100 mm. The beam is made up of steel with ultimate tensile strength of 540 N/mm^2 and tensile yield strength of 320N/mm^2. The construction of cantilever is such that there is no stress concentration. The size factor, surface finish factor and reliability factor are 0.85, 0.8, and 0.86 respectively. The operating temperature is 50 ^0C for which the temperature factor is 1.010. If the diameter of the beam is 35mm determine the life of the beam? [10]

4. A bracket plate carrying a load of 150 kN is to be welded to a column as shown in figure find the size of the weld, if the allowable shear stress in the weld is 120MPa. [10]



OR

5.a) Explain the 4 possible ways of failures in single rivet with suitable diagram for each case.

b) A circular bar of 50 mm diameter is welded to a steel plate by an annular fillet and is subjected to a twisting moment of 2 kNm. If the allowable shear stress in the weld material is 85 MPa, determine the size of the weld. [5+5]

6.a) A 16×10mm^2 cross section parallel key is to be used to transmit 60 kW power at 1440 rpm from a shaft of 45mm diameter. The key is made of plain carbon steel with yield strength of 300N/mm^2. If the required safety margin is 3, determine the key length.

b) List out the procedure for designing a knuckle joint stating all the empirical relations involved in it with suitable diagram. [6+4]

OR

7.a) Kennedy keys are used to transmit 30 kW power at 500 rpm from 40mm diameter shaft to the hub. The keys are made of steel 55C8 with yield strength of 400N/mm^2 and ultimate tensile strength of 700N/mm^2. If the factor of safety required is 3 and overload factor is 1.5 design the keys.

b) With neat diagram explain the design procedure involved in designing a cotter joint. [6+4]

8. A shaft supported between two bearings 400 mm apart carries an overhanging bevel gear at one end at a distance of 150 mm from the nearest bearing. The pitch circle diameter of bevel gear is 200mm. the tangential, radial and axial forces acting on the bevel gear are 28kN, 9.8kN and 2.9kN respectively. The shaft speed is 600 rpm. the ultimate and yield strengths of shaft material are 280 N/mm^2 and 135 N/mm^2 respectively. The combined shock and fatigue factors in bending and torsion are 1.5 and 1.0 respectively. Determine the shaft diameter also calculate the power transmitted by shaft. [10]

OR

9. A bushed –pin type flexible flange coupling is used to transmit 30kW power at 1440 rpm from an electric motor to a machine. If the peak torque is 20% more than the average torque, design the coupling. Assume following permissible stresses for the components of the coupling. Take permissible bearing pressure as 1N/mm^2. [10]

Type of stress N/mm^2	C.I FLANGE	PLAIN CARBON STEEL (shaft and key)	ALLOY STEEL (pin)
Allowable tensile stress	20	80	250
Allowable compressive stress	60	80	250
Allowable shear stress	15	35	125

10.a) Write a note on short peening in springs.

b) A semi elliptic leaf spring used for an automobile suspension consists of 3 extra full length leaves and 15 graduated leaves including the master leaf. The center to center distance between two eyes of the spring is 1 meter. The maximum force that can act on the spring is 75kN .the ratio of width to thickness for each leaf is 9:1. The leaves are pre stressed in such a way that when the force is maximum the stress induced in all leaves are 450 N/mm^2. If modulus of elasticity is 2.07×10^5N/mm^2. Determine

i) The cross section of the leaves

ii) The initial nip

iii) The initial preload required to close the gap between extra full lengths and graduated leaves. [3+7]

OR

11.a) Explain the surging of leaf springs.

b) A composite compression spring has two closed coil helical springs. The outer spring is 15 mm longer than the inner spring .The outer spring has 10 coils of mean diameter 40mm and wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. when the spring is subjected to an axial load of 400 N Find;

i) Compression of each spring

ii) Load shared by each spring

iii) Shear stress induced in each spring.

Modulus of rigidity may be taken as 84 kN/mm^2. [3+7]

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