Code No: 125DV **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May - 2018
DESIGN OF MACHINE MEMBERS - I
(Common to AME, ME)

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.

Illustrate your answers with NEAT sketches wherever necessary.

PART - A

(25 Marks)

1.a) Define 'Endurance limit'. [2]
b) What are the advantages of hole – basis system over shaft – basis system? [3]
c) What is 'caulking'? What is its objective? [2]
d) What is the cause of residual stresses in welded joints? How are they relieved? [3]
e) Where do you use a Knuckle joint? Give practical examples. [2]
f) Sketch the following types of keys**:** Taper sunk key, Feather key, Woodruff key. [3]
g) Define equivalent torsional moment and equivalent bending moment for a shaft. [2]
h) Give at least three practical applications of Couplings. [3]
i) What is helical torsion spring? How does it differ from helical compression spring? [2]
j) What is pulsating shear stress? Why are springs subjected to pulsating shear stress? [3]

PART - B

(50 Marks)

2.a) What is 'Preferred numbers or Preferred series'? What are its advantages?
b) The stresses at a point in a body are s_x = 90 N/mm^2, s_y = 20 N/mm^2, and s_{xy} = 80 N/mm^2. The material tests s_{yp} = 280 N/mm^2. Find the factor of safety according to the**:**
i) Maximum principal stress theory of failure,
ii) Maximum shear stress theory of failure
iii) Maximum strain energy theory of failure. [5+5]

OR

3.a) Explain the effects of Stress concentration in Fatigue loading.
b) A stepped shaft transmits a torque varying from 800 N-m to 1200 N-m. The ratio of diameters is 1.5 and the stress concentration factor is 1.2. Determine the diameter of the shaft for infinite life for a design factor of safety 1.8. The value of s_{ut} = 600 N/mm^2, and s_{yt} = 450 N/mm^2. [5+5]

4.a) Discuss the methods of failure of riveted joints.
b) Show that the plane of maximum shear stress occurs at 45^0 for a parallel load on a fillet weld of equal legs. Neglect bending. Determine the allowable force P per cm of weld length, if the allowable shear stress is 95 N/mm^2. [5+5]

OR

5.a) The maximum pull in the tie rods of a turnbuckle used in the roof truss is 4.5 kN. The tie rods are made of steel 40C8 (s_{yt} = 380 N/mm^2) and the factor of safety is 5. Determine the nominal diameter of the threads on the tie rod on the basis of Maximum principal stress theory. Assume $d_c = 0.8\,d$.

b) What is efficiency of riveted joint? How do you find it? [5+5]

6.a) What are the basic functions of keys? What are the factors on which the selection of the type of key for a given application depends?

b) Two rods are connected by means of a knuckle joint. The axial force acting on the rods is 25 kN. The rods and pin are made of plain carbon steel 45C8 (s_{yt} = 380 N/mm^2), and the factor of safety is 2.5. The yield strength in shear is 57.7% of the yield strength in tension. Calculate the diameter of the rods and the diameter of the pin. [5+5]

OR

7.a) What are the applications of a cotter joint? Explain.

b) A 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm width and 9 mm thickness made of steel with a yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. [5+5]

8.a) Distinguish between Shaft, Axle and Spindle.

b) A sleeve-coupling is used on a shaft of 40 mm diameter, delivering a torque of 50 N – m. Calculate the diameter of the pin required to hold the coupling, if the design stress for the pin material in shear is 100 MPa. [5+5]

OR

9.a) Explain the design procedure for Muff coupling.

b) A hollow circular shaft of outer and inner diameters d_o and d_i respectively is subjected to a torsional moment of M_t over a length l. The permissible angle of twist is θ degrees. Prove that the shaft diameter is given by: $d_o = \left[\frac{584 M_t l}{G\theta(1 - C^4)}\right]$, where $C = \left(\frac{d_i}{d_o}\right)$. [5+5]

10.a) How do you determine the natural frequency of helical springs?

b) A helical compression spring is subjected to an initial pre-load of 50 N, and the maximum force during the load cycle is 300 N. The wire diameter is 5 mm, and spring index is 5. The spring is made of oil-hardened and tempered steel wire of Grade-SW (s_{yt} = 1440 N/mm^2). Determine the factor of safety against fluctuating stresses. [5+5]

OR

11. A concentric spring consists of two helical compression springs, one inside the other. The free length of the outer spring is 25 mm greater than that of the inner spring. The wire diameter and mean coil diameter of the inner spring are 8 mm and 64 mm respectively. Also, the wire diameter and mean coil diameter of the outer spring are 10 mm and 80 mm respectively. The number of active coils in the inner and outer springs are 10 and 15 respectively. Assume the same material for both the springs. The modulus of rigidity of spring material is 81370 N/mm^2. Calculate the stiffness of spring when the deflection is more than 25 mm. [10]

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