Code No: 125DV **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 2019
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.

Illustrate your answers with NEAT sketches wherever necessary.

PART - A

(25 Marks)

1.a) Where do you use maximum shear stress theory of failure? [2]
b) Distinguish between fluctuating stress, repeated stress, and reversed stress. [3]
c) What is the relationship between the leg and throat of a fillet weld? [2]
d) Sketch any three types of rivet heads. [3]
e) Why is a cotter joint provided with a taper? And why is the taper provided only on one side? [2]
f) What is Kennedy key? What are its advantages and disadvantages over flat key? [3]
g) What is the difference between coupling and clutch? [2]
h) How are the hollow shafts generally manufactured? Explain. [3]
i) What is 'Wahl factor' in springs? Why is it used? [2]
j) Explain the following with respect to springs**:** Nip of leaf spring, Active coils of spring, Spring index. [3]

PART - B

(50 Marks)

2.a) Standardize six speeds between 250 to 1400 rpm, using the theory of preferred numbers.
b) What are the guidelines for selection of transition fits? Give examples. [5+5]

OR

3.a) What is Endurance limit? How do you estimate the Endurance strength of a material?
b) A 25 mm diameter shaft is made of forged steel 30C8 (s_{ut} = 600 N/mm^2). There is a step in the shaft, and the theoretical stress concentration factor at the step is 2.1. The notch sensitivity factor is 0.84. Determine the Endurance limit of the shaft, if it is subjected to a reversed bending moment. [5+5]

4.a) What are bolts of uniform strength? Where are they used? Explain with a sketch.
b) A double – riveted double – strap butt joint is used to connect two plates, each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear, and compression are 80, 60, and 120 N/mm^2 respectively. Find the efficiency of the joint. [5+5]

OR

5.a) A circular shaft , 75 mm in diameter, is welded to the support by means of a circumferential fillet weld. It is subjected to a torsional moment of 3 kN – m. Determine the size of the weld, if the maximum shear stress in the weld is not to exceed 70 N/mm^2.

b) Discuss the design of bolts with pre-stresses. [5+5]

6.a) Two rod ends of a pump are joined by means of a cotter and spigot and socket at the ends. Design the joint for an axial load of 100 kN which alternately changes from tensile to compressive. The allowable stresses for the material are 50 MPa in tension, 40 MPa in shear, and 100 MPa in crushing.

b) Why is taper provided on a sunk key? And why is the taper provided only on one side? [5+5]

OR

7.a) It is required to design a square key for fixing a pulley on the shaft, which is 50 mm in diameter. The pulley transmits 10 kW power at 200 rpm to the shaft. The key is made of steel 45C8 (s_{yt} = s_{yc} =380 N/mm^2) and the factor of safety is 3. Determine the dimensions of the key.

b) Why gibs are used in a cotter joint? Explain, with a sketch the use of double gib. [5+5]

8.a) Evaluate the inside and outside diameters of a hollow shaft for the following data. The design is to be made on the basis of torsional rigidity.
i) Power to be transmitted by shaft**:** 45 kW
ii) RPM of shaft**:** 500 rpm
iii) Ratio of inside diameter to outside diameter**:** 0.6
iv) Material of shaft: Carbon steel with (τ_{all} = 84 MPa).

b) Give the applications of Muff, Split muff and Flange couplings. [5+5]

OR

9.a) A cast iron flanged coupling is used to join two steel shafts 60 mm in diameter, delivering a maximum torque of 80 N – m . The two halves of the couplings are joined together by 4 bolts, placed equidistant on a bolt circle of 75 mm diameter. If the design stress is 70 MPa in shear for the bolt material, evaluate the diameter of the bolts.

b) What are Flexible shafts? Explain. [5+5]

10. A helical compression spring made of oil tempered carbon steel is subjected to a fluctuating load varying from 400 N to 1000 N. The spring index is 6, and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance strength in shear is 350 MPa, determine the (a) size of the spring wire, (b) diameters of the spring, (c) number of turns of the spring, and (d) free length of the spring. The compression of the spring at the maximum load is 30 mm. For the spring material, the modulus of rigidity is 80 kN/mm^2, and the spring ends are square and ground. [10]

OR

11.a) Distinguish between the series and parallel types of spring connections.

b) The spring for a spring balance is to elongate 14 cm when subjected to a load of 350 N. Determine the diameter of the wire, diameter of the coil, and the number of active turns required. Assume that the spring index is 7, and the maximum stress to be induced is 5,500 kg/cm^2. Take $G = 0.84 \times 10^6$ kg/cm^2. [5+5]

---ooOoo---