UNIT -IV (DESIGN OF SPRINGS AND LEVERS)

PART-A

1. What are the various types of springs?
2. Classify the helical springs.
3. Define: Leaf springs.
4. What are conical springs?
5. What is spring index?
6. What are active coils and inactive coils?
7. What is stiffness of spring?
8. What are the various spring materials?
9. What is a laminated leaf spring?
10. What are semi-elliptical leaf springs?
11. What is nipping of laminated leaf spring? Discuss its role in spring design.

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PART-B

1. A helical valve spring is to be designed for an operating load range of 90N to 135N.The deflection of
the spring for this load range is 7.5mm.Assuming a spring index of 10, a permissible shear stress of
480N/mm2 and a modulus of rigidity of 0.8Xl 05 N/mm2for the material, determine the dimensions of
the spring. (16)
2. A gas engine valve spring is to have a mean diameter 37.5mm.The maximum load will have to
sustain is 450N with a corresponding deflection of 12.5mm.The spring is to be subjected to repeated
loading and fatigue must be considered a low working stress of 300N/mm2 will be used. Find the size
for the wire and number of coil used. Take rigidity of modulus as 0.8XI05 N/mm2• (16)
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3. A compressive helical spring is required to exert a minimum force 250N and maximum force of
600N and the deflection for this change in load to be 15mm. The spring must fit in a hole of 30mm
diameter. The load is static. Ultimate tensile stress is 1393N/mm2 and shear stress is 606Mpa. (16)
4. A closely coil helical spring is made of 10mm diameter steel wire, the coil consisting of 10 complete
turns with a mean diameter of 120mm.The springs carries an axial pull of 200N.Determine also
deflection in the spring, its stiffness and strain energy stored by it if the modulus of rigidity of the
material is 80KN/mm2• (16)
5. A helical compression of spring made of oil tempered carbon steel is subjected to a load which varies

from 400N to 1000N. The spring index is 6 and the design factor of safety is 1.25.If the yield stress in
shear is 770Mpa ,and endurance stress in shear is 350Mpa,find,(1) Size of the spring wire (2) Diameter
of the spring wire (3) Number of turns of the spring (4) Free length of the
spring. The compression of the spring at the maximum load is 30mm.The modulus of rigidity for the
spring material may be taken as 80KN/mm^2. (16)
6. A semi-elliptical leaf spring of 1m long and is required to resist a load of 50KN.The spring has 15
leaves of which three are full length leaves. The width of central band is 100mm. All the leaves are to
be stressed to 420MPa.The ratio of total depth to width is 3.Take,
=2.1Xl0_5MPa.Determine,
(i) The thickness and width of the leaves.
(ii)The initial gap that should be provided between the full lengths and graduated leaves before
assembly.
(iii)The load exerted on the band for the assembly. (16)
7. A leaf spring for a small trailer is to support a load of 8KN. The spring has 8 graduated leaves and 2
free full length leaves of spring steel of safe stress 380MPa.The over all length 1m and the central band
is 80mm wide. Taking ratio of total depth of leaves as 3.Design the spring and also determine the
deflection of the spring. Take, E=2.1Xl0_5MPa. (16)
8. Design of leaf spring for a truck to the following specifications:
Maximum load on the spring = 140KN No of spring = 4
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Material for spring chromium vanadium steel Permissible tensile stress = 600N/mm^2
Maximum number of leaves =10
Span of spring = 1000mm
Permissible deflection = 80mm
Young's modulus of the spring = 200N/mm^2 (16)
9. Design a cantilever leaf spring to absorb 600N-m energy without exceeding a deflection of 150mm
and a stress of 800N/mm^2• The length of the spring is 600mm. The material of the spring is
steel.Take,E=200KN/mm^2