BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - V MECHANICAL : : SUMMER - 2022
SUBJECT : MACHINE DESIGN-I

Day : Monday
Date : 30-05-2022

S-13445-2022

Time : 10:00 AM-02:00 PM
Max. Marks : 60

N.B:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.
4) Use of non- programmable **CALCULATOR** is allowed.

Q.1 What is the use of preferred series explain with example. **(10)**

OR

Define 'Mechanical property' of in engineering material state any six mechanical properties, give their definitions with example.

Q.2 Explain classification of various keys with neat sketch. Explain design procedure for rectangular key. **(10)**

OR

A steel solid shaft transmitting 15 kW at 200 r.p.m. is supported on two bearings 750 mm apart & has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing & delivers power horizontally to the right. The gear housing 100 teeth of 5 mm module is located 150 mm to the right of the module is located 150 mm to the right of the left hand bearing & receives power in vertical direction from below. Using an allowable stress of 54 MPa in shear determine the diameter of the shaft.

Q.3 What is the design procedure to calculate the torque to overcome friction at collar? **(10)**

OR

A power screw having double start square threads of 25 mm nominal diameter & 5 mm pitch is acted upon by an axial load of 10 kN. The outer & inner diameters of screw collar are 50mm & 20 mm respectively. The coefficient of thread friction & collar friction may be assumed as 0.2 & 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar & allowable thread bearing pressure of 5.8N/mm^2
find:
1 the torque required to rotate the screw
2. the stress in the screw
3. The number of threads of nut in engagement with screw.

Q.4 Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6mm. Assume a spring index of 5. The permissible shear stress intensity as 420 MPa & modulus of rigidity is G= 84 kN/mm^2 **(10)**

Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring showing details of the end coils

OR

a) Free end of a helical torsion spring deflects through 90^0 when subjected to a torque of 4 N-m. Spring index is 6. Determine the coil diameter, wire diameter & number of turns with following data **(05)**
modules of rigidity= 80 GPa, modules of elasticity = 200 GPa. Allowable stress= 500N/mm^2

b) Explain various components of leaf spring with neat sketch. **(05)**

P.T.O

Q.5 **a)** What are the stresses are induced in the Butt weld **(05)**

b) What are the stress are induced in fillet welds **(05)**

OR

Design the longitudinal joint for a 1.25 m diameter steam boiler to carry a steam pressure of 2.5 N/mm^2. The ultimate strength of the boiler plate may be assumed as 420 MPa, crushing strength as 650 MPa & shear strength as 300 MPa. Take the joint efficiency as 80%. Sketch the joint with all the dimensions .adopt the suitable factor of safety.

Q.6 A cantilever beam of circular cross section, made of alloy steel 30 Ni4Crl (s_{ut}= 1500 N/mm^2) is fixed at one end & subjected to a completely reversed force of 1000N at the free end. The force is perpendicular to the axis of the beam. The distance between the fixed & free end of the cantilever beam is 400 mm. The theoretical stress concentration factor and notch sensitivity are 1.33 and 0.85 respectively. The surface finish factor & size factor are 0.79 & 0.85 respectively. The temperature factor & reliability factor are 0.975 & 0.868 respectively .The desired life of the beam is 50,000 cycles. If the required factor of safety is 1.5 determine, the diameter of the beam. **(10)**

OR

The mechanical components is subjected to the following bending stress cycles.

i) ± 350 N/mm^2 for 70% of time.

ii) ±500 N/mm^2 for 5% of time.

iii) ± 300 N/mm^2 for remaining time

The component is made of plain carbon steel 50 C 4& (s_{ut}= 660 N/mm^2). If the endurance limit of the components is 280 N/mm^2 determine its life.

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