T.E mechanical / MD-I / CBCS . VI

[Time: 03 Hours]

[Total marks: 80]

- 5 DEC 2019

N.B.
1. Question No.1 is compulsory
2. attempt any three out of remaining questions
3. Draw neat sketches to illustrate your answers
4. Figures to the right indicate full marks.
5. Use of **Standard Data Book** is permitted

Q1 Answer any **four** of the following   20
  a) What is the necessity of theories of failure? List different theories of failure
  b) Explain overhauling and self-locking of screw.
  c) What are the assumptions made in analysis of curved beam
  d) Explain the nipping of the leaf spring with neat sketch.
  e) Explain aesthetic consideration in design with suitable examples.

Q2 a) Design socket and spigot joint for 100kN, which varies from tension to compression.   14
     Select suitable material, factor of safety and draw neat sketch.
   b) Explain Notch sensitivity and Endurance limit related to design of machine elements   06
     subjected to variable loads.

Q3 a) Design screw, nut, and handle of screw jack to lift a load of 90kN through a height of   12
     400mm. select suitable material and factor of safety to design screw jack.
   b) Design a helical valve spring for an operating load range of 600N to 1200N. The   08
     compression at the maximum load is 30mm. Take the spring index 6 and permissible
     endurance shear stress for spring material as 480Mpa and yield stress in shear is
     960Mpa and $G = 80kN/mm^2$

Q4 a) Design flange coupling to connect the output shaft of an electrical motor to the shaft   14
     of centrifugal pump. The motor delivers a power of 20KW at 960rpm. The overall
     torque for motor is 18% higher of mean torque.
   b) Define stress concentration and discuss the various methods to reduce the effect of   06
     stress concentration.

Q5 a) A horizontal nickel steel shaft rests on two bearings, A at the left and B at the right   14
     end and carries two gears C and D located at distances of 250 mm and 400 mm
     respectively from the centre line of the left and right bearings. The pitch diameter of
     the gear C is 600 mm and that of gear D is 200 mm. The distance between the centre
     line of the bearings is 2400 mm. The shaft transmits 20 kW at 120 r.p.m. The power is
     delivered to the shaft at gear C and is taken out at gear D in such a manner that the
     tooth pressure F_{tC} of the gear C and F_{tD} of the gear D act vertically downwards. Find
     the diameter of the shaft, if the working stress is 100 MPa in tension and 56 MPa in
     shear. The gears C and D weighs 950 N and 350 N respectively. The combined shock
     and fatigue factors for bending and torsion may be taken as 1.5 and 1.2 respectively.

   b) What is preferred number? Explain use of preferred number in engineering design?   06

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Q6 a) Select suitable standard hook for the lifting load of 110kN of trapezoidal cross section   12
and find the stress induced at the most critical cross section of the hook.

b) A rectangular steel plate is welded as a cantilever to a vertical column and supports a   08
single concentrated load P, as shown in Figure. Determine the weld size if shear stress
in the same is not to exceed 140 MPa.

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