CBI1327

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Machine Design - II (New)
(1090)

P. Pages : 3

Time : Four Hours   Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** sub questions from each question.
5. Draw neat diagrams wherever necessary.
6. Assume suitable data if necessary.
7. Use of design data book, Non programmable calculator is allowed.

UNIT - I

1. a) A cone clutch with asbestos friction lining transmits 30kw power at 500 rpm. The coefficient of friction is 0.2 and the permissible intensity of pressure is 0.35 N/mm^2. The semi - cone angle is $\alpha = 12.5°$. The outer diameter is fixed as 300 mm from space limitations. Assuming uniform wear theory, Calculate :
    i) The inner diameter.
    ii) The face width of the friction lining.
    iii) The force required to engage the clutch.   **10**

   b) Explain :   **10**
    i) Centrifugal clutch
    ii) Construction and working of internal expanding brake.

   c) A four - wheeled automobile car has a total mass of 1000kg. The moment of inertia of each wheel about a transverse axis through its centre of gravity is 0.5 kg-m^2. The rolling radius of the wheel is 0.35m. The rotating and reciprocating parts of the engine and transmission system are equivalent to a moment of inertia of 2.5 kg - m^2, which rotates at five times the road wheel speed. The car is traveling at a speed of 100 km/hr on a plane road. When the brakes are applied, the car decelerates at 0.59. There are brakes on all four wheels.
   Calculate :
    i) The energy absorbed by each brake &
    ii) The torque capacity of each brake.   **10**

UNIT - II

2. a) The following data is given for an open - type V-belt drive.   **10**

    diameter of driving pulley = 200mm
    diameter of driven pulley = 600mm
    groove angle for sheaves = 34°
    mass of belt = 0.5kg/m
    max permissible tension in belt = 500N
    Coefficient of friction = 0.2
    contact angle for smaller pulley = 157°
    speed of smaller pulley = 1440rpm.
    power to be transmitted = 10kw.
    How many V-belts should be used, assuming each belt takes its proportional
    part of the load ?

    b) Write basic steps for design of chain drive by considering all standard
    references.   **10**

    c) Explain the basic types of product forms in aesthetic design. Also explain
    man-machine closed loop.   **10**

UNIT - III

3. a) A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth
    pinion meshing with a 41 teeth gear. The module is 3mm while the face
    width is 40mm. The material for pinion as well as for the gear is steel with an
    ultimate tensile strength of 600 N/mm^2. The gears are heat-treated to a
    surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service
    factor for the application is 1.75. Assume that velocity factor accounts for
    dynamic load and the factor of safety is 1.5. Determine the rated power that
    the gear can transmit.   **10**

    b) Explain with sketch force analysis of helical gears.   **10**

    c) A pair of helical gears consists of 24 teeth pinion rotating at 5000 rpm and
    suppling 2.5 kw power to a gear. The speed reduction is 4 : 1. The normal
    pressure angle and helix angles are 20° & 23° respectively. Both gears are
    made of hardened steel (Sut = 750 N/mm^2) the Cs = 1.5 & Fs = 2. The
    gears are finished to meet the accuracy of Grade - 4.   **10**

    i)   In the initial stages of gear design, assume that the velocity factor
    accounts for the dynamic load and that the face width is ten times the
    normal module. Assuming the pitch line velocity to be 10m/sec.
    estimate the normal module.

    ii) Select the first preference value of the normal module & calculate the
    main dimensions of the gear.

UNIT - IV

4. a) Explain & Derive beam strength of bevel gear.   **10**

    b) A pair of bevel gears, with 20° pressure angle, consists of 20 teeth pinion meshing with 30 teeth gear. The module is 4mm, while the face width is 20mm. The material for the pinion and gear is steel 50C4 (Sut = 750N/mm^2) The gear teeth are lapped and ground (class - 3) and the surface hardness is 400BHN. The pinion rotates at 500 rpm and receives 2.5kw power from the electric motor. The starting torque of the motor is 150% of the rated torque. Determine the factor of safety against bending failure and against pitting failure.   **10**

    c) Explain with sketch force analysis of worm & worm wheel.   **10**

UNIT - V

5. a) Explain with sketch Area - compensation method for nozzle opening in pressure vessel.   **10**

    b) The piston rod of a hydraulic cylinder exerts an operating force of 10KN. The friction due to piston packing and stuffing box is equivalent to 10% of operating force. The pressure in the cylinder is 10MPa. The cylinder is made of cast iron FG200 and the factor of safety is 5. Determine the diameter and the thickness of the cylinder.   **10**

    c) A ball bearing is operating on a work cycle consisting of three parts - a radial load of 3000N at 1440 rpm for one quarter cycle, a radial load of 5000N at 720 rpm for one half cycle and radial load of 2500N at 1440rpm for the remaining cycle. The expected life of the bearing is 10000hr. Calculate the dynamic load carrying capacity of the bearing.   **10**

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