[Time: 3 Hour]   [Total marks: 70]

Instructions:

    (1) Attempt all questions.
    (2) Figure to the **right** indicate full marks.
    (3) Assume suitable data if necessary.
    (4) Only scientific calculator is allowed.
    (5) Draw neat sketch wherever essential.

SECTION-I

Que.1
  (A) Explain different types ofbelt drives with sketch.   [5]
  (B) A fan running at 720 r.p.m. is driven by an electric motor running at 1440 r.p.m. through the 8   [7]
mm X 250 mm flat leather belt. The centre distance is 1370 mm. The coefficient of friction
between the belt and the pulley is 0.45 and belt mass is 957 kg per cubic metre. If the allowable
tensile stress for the belt material is 2.0 N/mm^2, determine:
    (i) the maximum power transmitting capacity of the belt,
    (ii) the diameter of the pulley, and   (iii) the required initial tension in the belt.

OR

Que.1
  (A) Derive the equation for ratio of limiting tension for V-belt.   [5]
  (B) Design a horizontal flat belt drive to transmit 25 kW from an electric motor to centrifugal water   [7]
pump. The motor runs at 1440 rpm. The pump is to operate at 720 rpm. The centre distance
between the pulleys is 4.5 m. Use the following design data:
      (a) Recommended range of belt speed: 17.8 m/s $\leq$ v $\leq$ 22.9 m/s
      (b) Load correction factor F_A = 1.2
      (c) Power rating per ply per mm width at 180° arc of contact and v = 5 m/s.
    HI - SPEED belting → 0.0118 kW/Ply/mm

Que.2   [3]
  (A) How will you distinguish between static and fatigue failures?   [4]
  (B) Explain various factors for correcting endurance limit.   [5]
  (C) A rectangular plate with center hole is subjected to completely reversed axial load of 20 kN as
shown in Fig-1. The notch sensitivity can be assumed as 0.8. Determine the plate thickness for
infinite life, if the factor of safety is 2.
Assume the ultimate tensile strength as 500 MPa. The surface factor is 0.8, size factor is 0.85
and the calculations are expected at 90% reliability, for which the reliability factor is 0.897. The
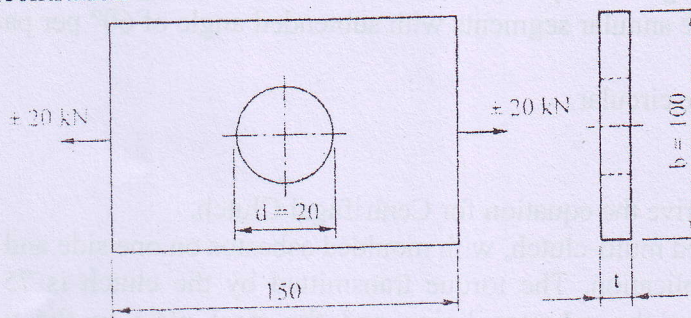theoretical stress concentration factor is 2.5.

Fig.-1

OR

Que.2

(A) Sketch and explain S-N diagram for ferrous and Non-ferrous material. Also Define Endurance limit. [5]

(B) A cantilever beam of circular cross section having ultimate tensile strength of 500 N/mm^2, is subjected to a completely reversed force of 1.2 kN as shown in **fig-2**. The notch sensitivity at the fillet is 0.6. Determine the diameter, 'd' for a life of 8000 cycles. Assume surface factor as 0.8, size factor as 0.9 and the calculations are expected at 90 % reliability, for which the reliability factor is 0.897. Theoretical stress concentration factor may be taken as 1.5. [7]
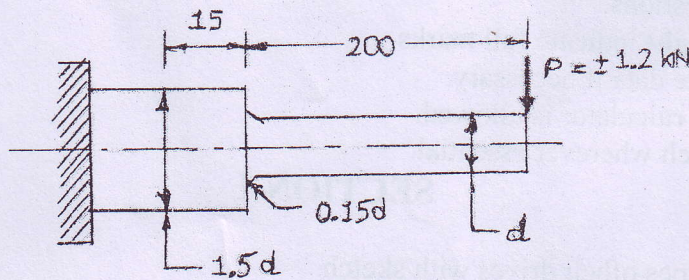

Fig.-2

Que.3

(A) Explain manufacturing considerations for Machining [3]

(B) Define Aesthetics. Explain Aesthetics consideration in design. [3]

(C) It is required to standardize load carrying capacities of dumpers in a manufacturing unit. The maximum and minimum capacities of such dumpers are 630 to 40 kN respectively. The company is interested in developing seven models in this range. Specify their load carrying models. [5]

SECTION – II

Que.4

(A) For the Pivoted block brake find the distance 'h' of the pivot from the center of the brake drum: [5]
$$h = 4.R.Sin\theta_1 / 2\theta_1 + Sin2\theta_1$$

(B) Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of (1) A single transverse weld, and (2) Double parallel fillet welds when the joint is subjected to variable loads. [6]

OR

Que.4

(A) Explain and derive equation for special cases of filet Welded Joints: [5]
    (1) Circular fillet weld subjected to Torsion,
    (2) Circular fillet weld subjected to Moment,
    (3) Long fillet weld subjected to Torsion.

(B) A caliper disk brake is to be designed for the front wheels of sports car. The required braking capacity of each break is 400 N-m^2. The inner and outer radius of the friction pads are 100 mm and 150 mm respectively. The coefficient of friction between the pads and rotating disk is 0.35, while the limiting intensity of pressure is 1 N/mm^2. Determine the required no. of pads, if: [6]
(1) The pads are annular segments with subtended angle of 60° per pad at the centre of the disk; and
(2) The pads are circular.

Que.5

(A) Explain and derive the equation for Centrifugal Clutch. [5]

(B) An oil immersed multi-clutch, with moulded asbestos on one side and steel disks on the other, is used in an application. The torque transmitted by the clutch is 75 N-m. The coefficient of friction between the asbestos lining and the steel plate in the wet condition is 0.1. The permissible intensity of pressure on the asbestos lining is 500 kPa. The outer diameter of the friction lining is kept as 100 mm due to space limitation. Assuming uniform wear theory. Calculate the inside diameter of disks, the required number of disks and the clamping force. [7]

Que.5

(A) Determine the optimum diameter ratio for torque transmission, considering uniform wear theory. [5]

(B) A single plate clutch (2 friction surfaces) can operate at a maximum lining pressure of 1 MN/m². The inner diameter is 140 mm, the outer diameter is 200 mm and the coefficient of friction is 0.5. If the clutch is operating in the uniform wear mode, what are the maximum torque that can be transmitted and the required normal force? [7]

Que.6 Attempt Any Three. [12]

(A) Enlist the advantages and disadvantages of Friction Clutch.

(B) Differentiates circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure.

(C) What are the advantages of disk brake over shoe brake?

(D) A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the radial stress at the inner, middle (radius = 125 mm) and outer surfaces.

Table:1 Arc of contact factor

Angle of wrap	120	130	140	150	160	170	180
Contact factor, F_d	1.33	1.26	1.19	1.13	1.08	1.04	1.00

Table:2 Standard pulley diameters

Number of plies	Minimum pulley diameter in mm at belt speeds in m/s			
	10	15	20	25
3	90	100	112	114
4	140	160	180	200
5	200	224	250	315
6	250	315	355	400
7	355	400	450	500

END OF PAPER