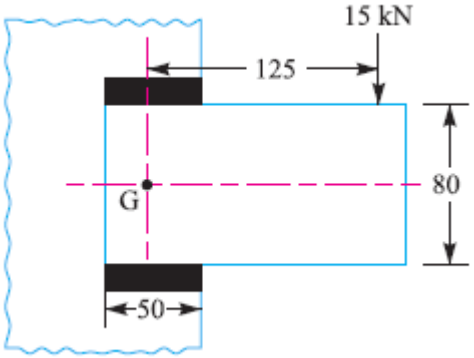
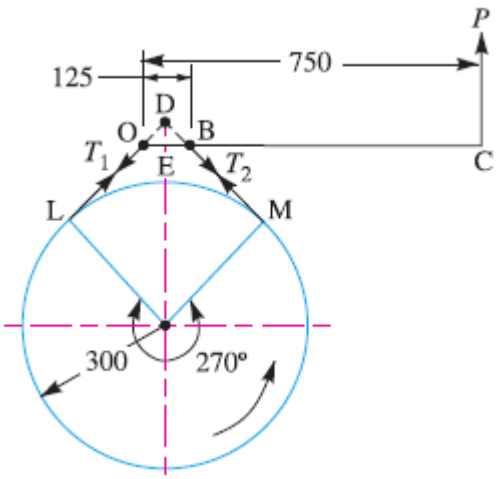
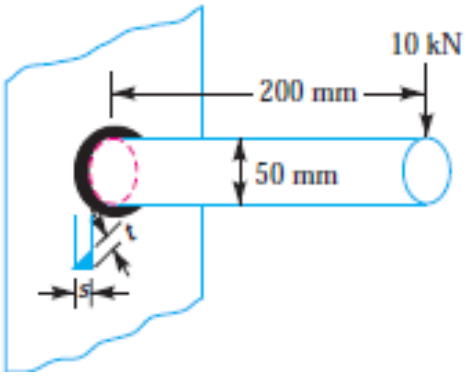
GUJARAT UNIVERSITY
BE SEM-7 (MECH) EXAMINATION QUESTION BANK
Design of Machine Components

Sr. no.	Question
1	The screw of a shaft straightener exerts a load of 30 kN. The screw is square threaded of outside diameter 75 mm and 6 mm pitch. Height of nut is 150 mm. Determine: 1. Force required at the rim of a 300 mm diameter hand wheel, assuming the coefficient of friction for the threads as 0.12; 2. Maximum compressive stress in the screw, bearing pressure on the threads and maximum shear stress in threads; 3. Efficiency of the straightener.
2	A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm^2. Calculate the tangential and radial tresses at the inner, middle (radius = 125 mm) and outer surfaces
3	Explain stresses in wire ropes.
4	A steel tube 240 mm external diameter is shrunk on another steel tube of 80 mm internal diameter. After shrinking, the diameter at the junction is 160 mm. Before shrinking, the difference of diameters at the junction was 0.08 mm. If the Young's modulus for steel is 200 GPa, find: 1. tangential stress at the outer surface of the inner tube; 2. tangential stress at the inner surface of the outer tube ; and 3. radial stress at the junction.
5	Derive equation for finding length of cross belt drive
6	Design a belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m, centre distance of 3.6 m, a belt speed 20 m / s, coefficient of friction 0.3, a slip of 1.2% at each pulley and 5% friction loss at each shaft, 20% over load
7	Explain Internal expanding shoe brake
8	Explain design of thick cylindrical shell subjected to internal and external pressure
9	Describe Goodman and Gerber criteria for variable loading.
10	Write a short note on fatigue considerations in design.
11	A bracket carrying a load of 15 kN is to be welded as shown in Figure. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa. Take $J = t*l(3b^2 + l^2)/6$ 
12	A multiple disc clutch, steel on bronze, is to transmit 4.5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is

	0.35 N/mm2. Find : 1. The total number of steel and bronze discs; 2. the actual axial force required; 3. the actual average pressure; and 4. the actual maximum pressure.
13	Explain types of welded joints.
14	A simple band brake, as shown in Figure, operates on a drum of 600 mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of 270°, (a) What is the pull necessary on the end of the brake arm to stop the wheel if 35 kW is being absorbed? What is the direction for this minimum pull? (b) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed 50 MPa? 
15	A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear.
16	Explain Aesthetic consideration in design
17	Explain Factors affecting in design process.
18	Explain Advantages and disadvantages of V belt over flat belt
19	Classification of Clutches
20	A multiple disc clutch, steel on bronze, is to transmit 4.5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is 0.35 N/mm2. Find : 1. The total number of steel and bronze discs; 2. the actual axial force required; 3. the actual average pressure; and 4. the actual maximum pressure.
21	A rope drum of an elevator having 650 mm diameter is fitted with a brake drum of 1 m diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m / s. The brake has a sufficient capacity to stop the elevator in 2.75 meters. Assuming the coefficient of friction between the brake drum and shoes as 0.2, find: 1. width of the shoe, if the allowable pressure on the brake shoe is limited to 0.3 N/mm2; and 2. heat generated in stopping the elevator
22	Derive equation for finding length of open belt drive
	Design a belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m, centre distance of 3.6 m, a belt speed 20 m / s, coefficient of friction 0.3, a slip of 1.2% at each pulley and 5% friction loss at each shaft, 20% over load

23	Explain band and block brake
24	Explain design of thick cylindrical shell subjected to internal and external pressure
25	Describe different criteria for variable loading.
26	Write a short note on Thermal considerations in design.
27	A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm2, find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw.
28	A hydraulic press has a maximum capacity of 1000 kN. The piston diameter is 250 mm. Calculate the wall thickness if the cylinder is made of material for which the permissible strength may be taken as 80 MPa. This material may be assumed as a brittle material.
29	Explain types of threads in power screw
30	A single plate clutch, effective on both sides, is required to transmit 28 kW at 3250 r.p.m. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.5 and the maximum pressure is not to exceed 0.15 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform pressure.
31	Assembly consideration in design
32	Factors affecting selection of material in design process.
33	Advantages and disadvantages of belt drive over chain drive
34	Classification of Brakes
35	Derive equation for finding tension ratio for belt drive
36	Explain Types of Belt drive
37	Write a short note on centrifugal clutch
38	A 50 mm diameter solid shaft is welded to a flat plate as shown in Fig. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. 
39	Explain change in dimensions of a Thin Cylindrical Shell due to an internal pressure
40	Write a short note on Ergonomics in Design.