PVP 20

Code: 20ME3603

III B.Tech - II Semester – Regular Examinations – JUNE 2023

DESIGN OF TRANSMISSION ELEMENTS
(MECHANICAL ENGINEERING)

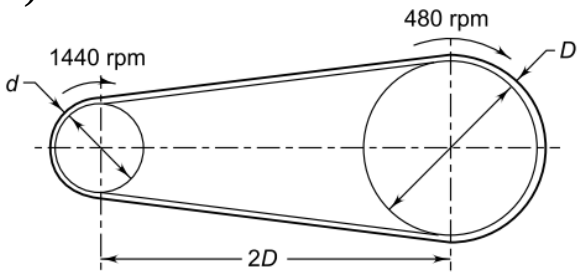
Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

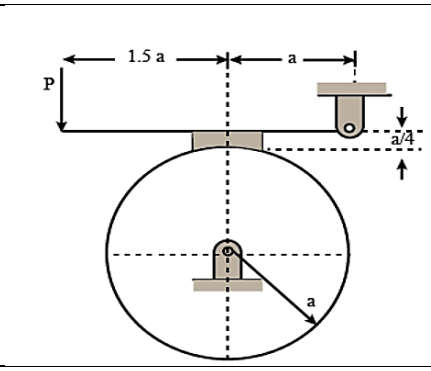
BL – Blooms Level CO – Course Outcome

*** Use of Approved Design Data book is permitted ***

			BL	CO	Max. Marks
UNIT-I					
1	a)	What are the advantages of hollow shaft over solid shaft?	L2	CO1	2 M
	b)	Find the diameter of a solid steel shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameters when the ratio of inside to outside diameter is 0.5.	L4	CO4	12 M
OR					
2		Design a muff coupling to connect two steel shafts transmitting 25 kW power at 360 rpm. The shafts and key are made of plain carbon steel 30C8 ($S_{yt} = S_{yc} = 400$ N/mm^2). The sleeve is made of grey cast iron FG 200 ($S_{ut} = 200$ N/mm^2). The factor of safety for the shafts and key is 4. For the sleeve, the factor of safety is 6 based on ultimate strength.	L4	CO4	14 M
UNIT-II					
3		The layout of a leather belt drive transmitting 15 kW of power is shown in Figure. The center distance between the pulleys is twice the diameter of the bigger pulley. The belt should operate at a velocity of	L3	CO2	14 M

		20 m/s approximately and the stresses in the belt should not exceed 2.25 N/mm^2. The density of leather is 0.95 g/cc and the coefficient of friction is 0.35. The thickness of the belt is 5 mm. Calculate: (i) the diameter of pulleys; (ii) the length and width of the belt; and (iii) the belt tensions.  			
OR					
4	a)	It is required to select a V-belt drive to connect a 20 kW, 1440 rpm motor to a compressor running at 480 rpm for 15 hours per day. Space is available for a center distance of 1.2 m. Determine (i) the specifications of the belt; (ii) diameters of motor and compressor pulleys; (iii) the correct center distance; and (iv) the number of belts.	L3	CO2	10 M
	b)	Mention the advantages of chain drives compared with belt and gear drives.	L2	CO1	4 M
UNIT-III					
5	a)	A single-row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The values of X and Y factors are 0.56 and 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of the shaft is 75 mm and Bearing No. 6315 (C =112000 N) is selected for this application. Estimate (i) Life of the bearing, with 90% reliability; and (ii) Reliability for 20000 h life.	L3	CO2	8 M
	b)	Discuss the different modes of lubrication in sliding contact bearings.	L2	CO1	6 M
OR					
6		A journal bearing is to be designed for a centrifugal pump for the following data:	L4	CO4	14 M

		Load on the journal = 12 kN, Diameter of the journal = 75 mm, Speed = 1440 rpm, Atmospheric temperature of the oil = 16°C, Operating temperature of the oil = 60°C, Absolute viscosity of oil at 60°C = 0.023 kg/m-s. Give a systematic design of the bearing.			
		UNIT-IV			
7	a)	A centrifugal clutch is to transmit 15 kW at 900 rpm. The shoes are four in number. The speed at which the engagement begins is 3/4th of the running speed. The inside radius of the pulley rim is 150 mm and the center of gravity of the shoe lies at 120 mm from the center of the spider. The shoes are lined with ferrodo for which the coefficient of friction may be taken as 0.25. Determine: (i) Mass of the shoes, and (ii) Size of the shoes, if angle subtended by the shoes at the center of the spider is 60^o and the pressure exerted on the shoes is 0.1 N/mm^2.	L3	CO3	10 M
	b)	What are requirements of friction material for brake lining?	L2	CO1	4 M
		OR			
8	a)	A multi-disk clutch transmits 50 kW of power at 1400 rpm. The permissible intensity of pressure not to exceed 0.15 N/mm^2, and the coefficient of the friction between surfaces is 0.12. the inner radius of the discs is 80 mm, and is 0.7 times the outer radius. Determine number of disks required to transmit the given power. Assume uniform wear condition.	L3	CO3	7 M
	b)	A single block brake with a short shoe and torque capacity of 250 N-m is shown in figure. The cylindrical brake drum rotates anti-clockwise at 100 rpm and the coefficient of friction is 0.25. Find the value of "a" in mm, such that the maximum actuating force P is 2000 N.	L3	CO3	7 M

					
		UNIT-V			
9		A pair of spur gears consists of a 24 teeth pinion, rotating at 1000 rpm and transmitting power to a 48 teeth gear. The module is 6 mm, while the face width is 60 mm. Both gears are made of steel with an ultimate tensile strength of 450 N/mm^2. They are heat treated to a surface hardness of 250 BHN. Assume that velocity factor accounts for the dynamic load. Calculate (i) beam strength; (ii) wear strength; and (iii) the rated power that the gears can transmit, if service factor and the factor of safety are 1.5 and 2, respectively.	L4	CO4	14 M
		OR			
10	a)	A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is 4 mm. Calculate (i) the center distance; (ii) the pitch circle diameters of the pinion and the gear; (iii) the addendum and dedendum; and (iv) the gear ratio.	L4	CO4	8 M
	b)	A pair of parallel helical gears consists of a 20 teeth pinion and the velocity ratio is 3:1. The helix angle is 15° and the normal module is 5 mm. Calculate (i) the pitch circle diameters of the pinion and the gear; and (ii) the centre distance.	L4	CO4	6 M