Register Number:……..

KUMARAGURU
college of technology
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Fifth Semester

MECHATRONICS ENGINEERING

U18MCT5105: Design of Machine Elements

COURSE OUTCOMES

CO1: Recognize the design process and the factors influencing it and design the simple components for static loading
CO2: Apply the basic concepts of design to Estimate the life of the components subjected to varying loads
CO3: Design the circular shafts based on strength and rigidity, keys and couplings for power transmission
CO4: Apply the basics of power transmission to select the belts
CO5: Design the welded joints, threaded joints and springs subjected to static and dynamic loads
CO6: Select the rolling contact bearings for static and cyclic loads

Use of Standard Design Data Book is permitted.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	List the types of design in machine design.	CO1	[K_1]
2.	What are the causes for stress concentration factor?	CO1	[K_2]
3.	Define factor of safety.	CO2	[K_2]
4.	Calculate the torque on shaft at speed of 500 rpm and input power is given maximum of 10kw.	CO3	[K_3]
5.	What is the significance of using coupling for power transmission?	CO3	[K_2]
6.	Discuss the different types of belts.	CO4	[K_1]
7.	List any three materials used for closed helical springs.	CO5	[K_2]
8.	How welded joint obtained and list any four types of welded joints.	CO5	[K_2]
9.	What do you mean by critical pressure of the journal bearing?	CO6	[K_2]
10.	Justify how bearing act as support on other elements and list any three types of bearings.	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Discuss on selection factors for considering the machine design.	8	CO1	[K_2]
	b)	Elaborate the various loads on machine elements during static and dynamic condition.	8	CO1	[K_2]
12.	a)	Solve to obtain the bending stress on the crane hook carries a load of 20 kN as shown in Fig.1. Its cross section at X-X is rectangular whose vertical and horizontal sides are 20mm, 100 mm. respectively. Calculate the stresses in the	16	CO2	[K_3]

inner and outer fibres at the given rectangular section.

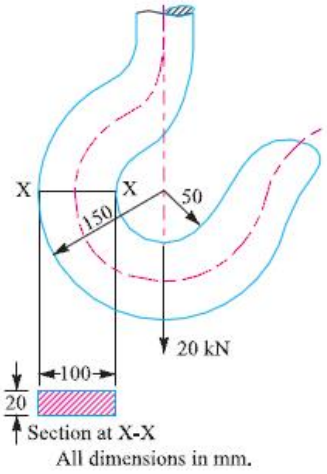

Fig.1

13. a) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : 16 CO3 [K3]
Shear stress for shaft, bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa.
Draw the flange coupling and indicate its dimensions.

14. a) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30°. The cross-sectional area of each belt is 750 mm^2 and $\mu = 0.12$. The density of the belt material is 1.2 Mg / m^3 and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys of 300 mm diameter rotating at 1500 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be maximum. 16 CO4 [K3]

15. a) A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, find : 1. Size of the spring wire, 2. Diameters of the spring, 3. Number of turns of the spring, and 4. Free length of the spring. The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80 kN/mm^2. 16 CO5 [K3]

16. a) Select a suitable journal bearing for a centrifugal pump from the following data : Load on the journal = 20 000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N / mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 $W/m^2/°C$. 16 CO6 [K3]

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