Register Number:……..

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

(Regulation 2018)

Fifth Semester

AUTOMOBILE ENGINEERING

U18AUT5102 : Design of Machine Elements

COURSE OUTCOMES

CO1: Familiarize and apply the design morphology in designing various machine element
CO2: Selecting suitable material for the machine elements
CO3: Calculate and analyze the forces acting on the Machine element
CO4: Choosing the appropriate machine element for the required function
CO5: Designing a machine element from the given data
CO6: Justify the design and present it in an effective manner

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

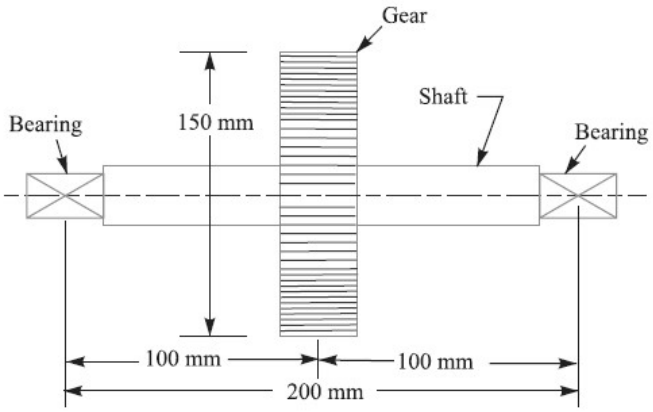
Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Differentiate adaptive design and development design.	CO1	[K_2]
2.	Define Optimum Design.	CO1	[K_2]
3.	Mention the materials used for shaft design.	CO2	[K_2]
4.	List down the two forms of helical spring.	CO2	[K_2]
5.	Where the Helical gears are used?	CO3	[K_2]
6.	Explain central distance in gears.	CO3	[K_2]
7.	Define Lewis equation.	CO6	[K_2]
8.	Explain Radial bearing & Thrust bearing.	CO4	[K_2]
9.	Discuss about partial journal bearing.	CO5	[K_2]
10.	List out the assumptions in hydrodynamic lubricated bearings.	CO6	[K_2]

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

11.	a)	Discuss about the general consideration in Machine design.	CO1	[K_2]
	b)	Construct a flow diagram and explain general procedure for Machine design.	CO1	[K_2]
12.	a)	A shaft supported at the ends in ball bearings carries a straight tooth spur gear	CO2	[K_3]

at its mid span and is to transmit 7.5 kW at 300 r.p.m. The pitch circle diameter of the gear is 150 mm.The distances between the centre line of bearings and gear are 100 mm each. If the shaft is made of steel and the allowable shear stress is 45 MPa, determine the diameter of the shaft. Show in a sketch how the gear will be mounted on the shaft; also indicate the ends where the bearings will be mounted? The pressure angle of the gear may be taken as 20°.



b) A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5 metre in diameter and has belt tensions 5.4 kN and 1.8 kN on the tight side and slack side of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the centre line of the bearing being 400 mm, find the diameter of the shaft. Assuming maximum allowable shear stress of 42 MPa. CO3 [K_3]

13. a) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. CO4 [K_3]

14. a) A motor shaft rotating at 1500 r.p.m. has to transmit 15 kW to a low speed shaft with a speed reduction of 3:1. The teeth are 1 °14 /2 involute with 25 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe stress of CO5 [K_3]

200 MPa. A safe stress of 40 MPa may be taken for the shaft on which the gear is mounted and for the key. Design a spur gear drive to suit the above conditions. Also sketch the spur gear drive. Assume starting torque to be 25% higher than the running torque.

15. a) A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm^2. The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. CO5 [K_3]

Find:

1. The amount of artificial cooling required, and
2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C.

Take specific heat of the oil as1850 J / kg / °C.

b) A journal bearing 60 mm is diameter and 90 mm long runs at 450 r.p.m. The oil used for hydrodynamic lubrication has absolute viscosity of 0.06 kg / m-s. If the diametral clearance is 0.1 mm, find the safe load on the bearing. CO5 [K_3]

16. a) Briefly explain about coefficient of fluctuation of energy. CO6 [K_2]

b) Derive an equation to calculate energy stored in a flywheel. CO5 [K_3]

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