U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Automobile Engineering

Semester End Examination; Feb. - 2021

Design of Machine Elements - II

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Analyze the stresses in the critical section of a curved beam and design springs for different applications.

CO2: Design Spur and helical and gears.

CO3: Design Bevel and worm gears.

CO4: Design clutches and brakes, with an understanding of safety issues related to brakes.

CO5: Select lubricants and design sliding contact bearings, select rolling contact bearings for different applications.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*

Q. No.		Questions	Marks	BLs	COs	POs
		I : PART - A	**10**			
I	a.	List the assumptions made in finding stress distribution.	2	L1	CO1	PO1
	b.	List the properties of involute tooth profile.	2	L1	CO2	PO1
	c.	Explain self locking in worm gearing.	2	L1	CO3	PO1
	d.	Explain the creep phenomenon in belt drives.	2	L1	CO4	PO1
	e.	List different types of bearings.	2	L1	CO5	PO1
		II : PART - B	**90**			
		UNIT - I	**18**			
1	a.	Derive the expression for bending stress in curved beams.	8	L2	CO1	PO2
	b.	The section of crane hook is rectangular in shape whose width is 30 mm and depth is 60 mm. The centre of curvature of the section is at a distance of 125 mm from the inside section and the load line is 100 mm from the same point. Find the capacity of the hook, if the allowable stress in tension is 75 N/mm^2.	10	L3	CO1	PO2
	c.	A helical value spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection of the spring for the load range is 7.5 mm. Assume a spring index of 10 and factor of safety = 2. Design the spring.	10	L3	CO1	PO3
		UNIT - II	**18**			
2	a.	Derive an expression for beam strength of a spur gear tooth with standard notation.	4	L2	CO2	PO2
	b.	A cast steel spur gear pinion having 21 teeth and rotating at 1500 rpm is required to transmit 9 kW to a high grade CI gear to run at 500 rpm. The teeth are $14\frac{1}{2}^\circ$ involute form. Design the gear completely.	14	L4	CO2	PO4

Contd…2

	c. Design a pair of helical gear to transmit 12 kW at 1200 rpm of pinion. The velocity ratio 3:1 pinion has 24 teeth and is made of 0.4% carbon steel untreated. The gear is made of cast steel. The teeth are $14\frac{1}{2}^{\circ}$ involute form in normal plane. Helix angle is 25°.	14	L4	CO2	PO3
	UNIT - III	**18**			
3 a.	Explain briefly the formative number of teeth of bevel gears.	4	L2	CO3	PO1
	b. Two shafts inclined at 60° are connected by pair of bevel gears to transmit 9 kW at 900 rpm of 24 teeth cast steel pinion. The gear is made of high grade CI and is to run at 300 rpm. The teeth are $14\frac{1}{2}^{\circ}$ involute form. Design the gear.	14	L4	CO3	PO3
	c. Design a worm gear drive to transmit 12 kW at 1200 rpm. Speed reduction designed is 30:1. The worm is made of hardened steel (σ_0 = 210 MPa) and gear of phosphor bronze (σ_0 = 90 MPa). The teeth are $14\frac{1}{2}^{\circ}$. Determine the heating capacity of the gears.	14	L4	CO3	PO3
	UNIT - IV	**18**			
4 a.	Write a note on the effect of 'slip' on velocity ratio in belt drives.	6	L2	CO4	PO1
	b. Select a V - belt drive to transmit 10 kW of power from a pulley of 200 mm pitch diameter mounted on an electric motor running at 720 rpm to another pulley mounded on compressor running at 200 rpm. The service is heavy duty varying from 10 hours to 14 hours per day and centre distance between centre of pulleys is 600 mm.	12	L3	CO4	PO2
	c. A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 210° while one end is connected to the fulcrum. The other end is connected to the brake lever at a distance of 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb 15 kW at 720 rpm. Design the brake lever of rectangular cross section assuming the depth to be thrice the width. Take allowable stress as 80 MPa.	12	L3	CO4	PO3
	UNIT - V	**18**			
5 a.	Derive Petroff's equation for coefficient of friction.	6	L2	CO5	PO1
	b. Design the main bearings of a 4-stroke diesel engine to sustain a load of 6 kN. The operating speed of the shaft is 100 rpm.	12	L2	CO5	PO2
	c. Select a suitable ball bearing for the spindle of a drilling machine rotating at 1200 rpm. The bearing is subjected to work for 8 hrs / day for a service life of $5\frac{1}{2}$ years. Based on strength, the minimum diameter of spindle is 50 mm.	12	L3	CO5	PO2

* * *